STATE OF MINNESOTA DISTRICT COURT
COUNTY OF RAMSEY SECOND JUDICIAL DISTRICT

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The State of Minnesota,
by Hubert H. Humphrey, III,
its attorney general,
and
Blue Cross and Blue Shield
of Minnesota,
Plaintiffs,
vs. File No. C1-94-8565
Philip Morris Incorporated, R.J.
Reynolds Tobacco Company, Brown
& Williamson Tobacco Corporation,
B.A.T. Industries P.L.C., Lorillard
Tobacco Company, The American
Tobacco Company, Liggett Group, Inc.,
The Council for Tobacco Research-U.S.A.,
Inc., and The Tobacco Institute, Inc.,
Defendants.

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TRANSCRIPT OF PROCEEDINGS
VOLUME 50, PAGES 9764 - 9988
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P R O C E E D I N G S.

THE CLERK: All rise. Ramsey County District Court is again in session, the Honorable Kenneth J. Fitzpatrick now presiding.

(Jury enters the courtroom.)

THE CLERK: Please be seated.

THE COURT: Good morning.

(Collective "Good morning.")

THE COURT: Counsel.

MR. WEBER: Thank you, Your Honor. Dr. Townsend.

DAVID E. TOWNSEND
called as a witness, being previously sworn, was examined and testified as follows:

DIRECT EXAMINATION (cont'd)

BY MR. WEBER:

Q. Good morning, Dr. Townsend.

A. Good morning.

MR. WEBER: Good morning, ladies and gentlemen.

(Collective 'Good morning.")

Q. Dr. Townsend, if you remember where we were last Friday when we broke, you had identified two methods of design or engineering, one selective reduction,

one general reduction.

A. That's correct.

Q. And do you recollect that we had also talked

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about the 1989 Surgeon General's report, a number of compounds that had been identified over time?
A. That's correct.
Q. And some of those compounds had been identified as potentially hazardous; correct?
A. Yes.
Q. Now, did the selective reduction theory and design efforts focus on compounds that had been claimed to be hazardous in cigarette smoke?
A. It did. That was the -- the center of selective reduction.
Q. What was Reynolds' first major effort in the selective-reduction area?
A. It was in the area of trying to reduce or eliminate benzpyrene.
Q. Is that also referred to as shorthand as BaP?
A. That's correct.
Q. What is BaP, doctor.
A. BaP or benzpyrene is a polycyclic aromatic hydrocarbon, it's a multi-ring aromatic organic compound.
Q. And is it present in cigarette smoke?

A. Yes, it is.
Q. And in what quantities, doctor?
A. Well we know today that it's present in cigarette smoke at the nanogram level, which again the billionths-of-gram-per-cigarette level.
Q. Based on your background in chemistry, is BaP present in other things we eat and drink as well?
MR. CIRESI: Objection, Your Honor, it's irrelevant.
THE COURT: No, you may answer.
A. It is present in a number of other things, agricultural products, from exposure to air pollution, it's present as a result of pretty much any combustion system, including diesel exhaust, automobile exhaust. So there are a number of places that BaP is found.
Q. Roasted foods?
A. Absolutely.
Q. How does the BaP level in smoke compare with BaP levels found in other things that people come in contact with?
MR. CIRESI: Objection, irrelevant. There's no qualifications for this witness to testify to biological significance.
THE COURT: Sustained.

BY MR. WEBER:
Q. Without commenting on the biological significance, but purely as a matter of chemical analysis, how does the BaP level in smoke compare with the BaP level in other things that people eat and drink, doctor?
MR. CIRESI: Objection, irrelevant.
THE COURT: You may answer that.

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A. The level of BaP in cigarettes compared to, say, for example, a charcoal-broiled steak, is actually very interesting. A charcoal-broiled steak, it turns out, when the fat drips from a steak on the grill, the fat can land in the -- in the hot coals. The fat then undergoes -- undergoes pyrolysis, similar to what we were talking about Friday, and -- and can actually form benzpyrene, which is then carried back up to the steak and deposited on the steak.

Typical levels of BaP in a charcoal-broiled steak are roughly the equivalent of about 600 cigarettes' level of BaP.

Q. Now Dr. Townsend, how is it that BaP became the focus of the first major effort at selective reduction at Reynolds?

A. I think there were two major reasons that BaP was the first focus for selective reduction. First

of all, benzpyrene had previously been known to be carcinogenic; that is, it caused excess tumors in mouse skin-painting studies when applied as a neat solution. The second reason that benzpyrene was focused on was because it was thought to be present in -- from pretty much any combustion system, diesel exhaust, burning leaves, and probably a burning cigarette. So it certainly was the focus because of both of those reasons.

Q. Now what did the researchers at Reynolds do regarding selective reduction and benzpyrene?

A. Well we did three -- three major things. The first thing was to determine if in fact benzpyrene was present in cigarette smoke. The second -- and we did determine that, yes, it was present. The second thing was to determine the level, and we found that the level of benzpyrene in cigarette smoke is typically in the -- in the nanogram range, as I've already said. And then the third major thing we tried to do was to reduce or eliminate the levels in -- in mainstream cigarette smoke.

Q. Now doctor, before we get into those methods of attempting to reduce or eliminate, I want you to assume that plaintiffs have raised a question in this case about whether it was known outside of the

cigarette companies and in the public literature as to whether BaP was presented in smoke, and that in this regard plaintiffs referred to the document that's at tab eight, which is PX12418, an R. J. Reynolds document which is in evidence.

A. You said tab eight?

Q. Tab eight. Memorandum of Dr. Rodgman's dated November 2, 1959. Do you see that?

MR. CIRESI: The exhibit, please.

MR. WEBER: I'm sorry, I thought I said that. PX12418.

A. I have it.

Q. And also a Brown & Williamson document marked

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PX13555, which is at tab nine.
A. I see that also.
Q. All right. Now the R. J. Reynolds document is dated November 2, 1959; correct?
A. That's correct.
Q. And let me just show the cover sheet on this for the ladies and gentlemen of the jury so they can recollect that document.
And then for the Brown & Williamson document marked 13555, that's the one that on page nine said that the Brown & Williamson lab until the past had made a partial isolation and identification. Do you

see that?
A. Yes, I see that.
Q. Now let me ask you this: Do you know whether the presence of benzpyrene in smoke had been reported in the popular and scientific literature prior to the dates of these memoranda?
MR. CIRESI: Your Honor, I'm going to object to counsel's characterization of the issue as to why it was raised. It's a misstatement of the record.
THE COURT: All right. You should rephrase your question, counsel.
MR. WEBER: All right.
BY MR. WEBER:
Q. Let -- let me ask this: Do you know whether in the popular or scientific literature it had been reported -- the presence of benzpyrene in smoke had been reported in 1950?
MR. CIRESI: Objection, no foundation on the part of this witness.
THE COURT: Okay. You may answer that.
A. I do know that, and it was reported in Reader's Digest in 1950.
Q. Could you turn to tab 10 of the notebook. That's Exhibit GL000089.

A. Yes, sir.
Q. And can you identify that as a January 1950 Reader's Digest article entitled "HOW HARMFUL ARE CIGARETTES?"
A. That's correct, that's what it is.
MR. WEBER: Your Honor, I'd move the admission of that under 902(6) as self-authenticating and under 803(16) as an ancient document.
MR. CIRESI: It's hearsay. If he's introducing it for notice, I have no objection to that, Your Honor.
MR. WEBER: Well under the rule, as the court and Mr. Ciresi know, 803(16) eliminates the hearsay as an ancient document. It's an exception to the hearsay rule explicitly.
MR. CIRESI: No, it's not an exception; you still need the predicate. It's an ancient document with respect to a party's statements. We have no

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objection to this on notice. It's self-authenticating, Your Honor, but it's -- we have no objection on notice.

THE COURT: All right. It will be received on notice, GL000089.

BY MR. WEBER:

Q. Dr. Townsend, could you turn to the last

paragraph. It starts on page one. And just so we see, Reader's Digest, and the date of this is January 1950, and the article is entitled "HOW HARMFUL ARE CIGARETTES?" Could you start this paragraph and read that at the bottom of page one over to page two.

A. Yes. "What is -- What is this substance which we breathe into our mouths and lungs in such stupendous clouds? It contains a number of ominous-sounding chemicals. Medical men, however, have not proved a case against them. But two of the chemicals are under grave suspicion: benzo-pyrene, which chiefly affects the respiratory tract, and nicotine."

Q. All right. Now this article appeared nine years before Dr. Rodgman's document?

A. That's correct.

Q. And two years before the B&W document we just referenced?

A. That's also correct.

Q. With reference to PX12418, which is that November 1959 memorandum by Dr. Rodgman we just referred to, let me ask you whether the same month of that same year there was another Reader's Digest article dealing with polycyclic aromatic hydrocarbons and smoke?

A. There was.

Q. Would you turn to page -- strike that -- tab 11, please, in your notebook. That is BYT000404.

A. I have it.

Q. Can you identify that as a November 1959 Reader's Digest article entitled "THE SEARCH FOR 'SAFER' CIGARETTES?"

A. That's correct.

MR. WEBER: Your Honor, I'd move that under 902(6) and 803(16) again.

MR. CIRESI: Your Honor, again under notice we have no objection.

THE COURT: All right. Court will receive BYT000404.

MR. WEBER: Your Honor, can I approach at side-bar just for a moment?

THE COURT: We had such a nice start this morning.

MR. WEBER: This will be a brief one, I promise you.

THE COURT: All right.

MR. WEBER: Thank you.

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(Side-bar discussion as follows:)

(Side-bar discussion concluded.)

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BY MR. WEBER:
Q. With reference to BYT000404, you've reviewed that document?
A. Yes.
Q. Can you turn to the first full paragraph on page 44 of that article where it's entitled "The Coming Chemistry."
A. Yes.
Q. Could you read that paragraph for us, please, doctor.
A. Yes. "The Coming Chemistry. The carcinogenic, parenthesis, (cancer-causing) factor in cigarette smoke is much less a mystery than it was a few years ago. Scientists are convinced that the primary carcinogens are higher polycyclic hydrocarbons formed by the combustion of tobacco at high temperature, parenthesis, (about 880 degrees Centigrade in the cigarette ember). They have identified eight carcinogenic polycyclics in tobacco smoke, and are on the trail of others."
Q. Now is benzpyrene a higher polycyclic hydrocarbon?
A. Yes, it is.
Q. Now this says that there have been identified eight carcinogenic polycyclics; correct?

A. That's correct. That's what it says.
Q. In Dr. Rodgman's memorandum in the same month, November '59, how many carcinogenic polycyclics does Dr. Rodgman say are known?
A. In the 1959 memorandum of Dr. Rodgman, he identified eight -- or he said that there were eight known.
Q. So how does the number identified by Dr. Rodgman compare to the number in Reader's Digest, both in 19 -- in November 1959?
A. It's the same.
Q. Now by the way, does Dr. Rodgman's memorandum we've been referring to, PX12418, deal with any particular design or research engineering?
A. Well it does, and he talks about attempts to try to remove or reduce benzpyrene, he talks about some cigarette construction issues.
Q. Does that memorandum refer to a method of potential extraction?
A. Yes, it does on page two, particularly under paragraph number one.
Q. Okay. We'll get to a discussion of the extraction method later.
At this point, Dr. Townsend, I'd like you to turn to another of Dr. Rodgman's memorandum at tab

12, that's PX18187, that's already in evidence, and I'd like you to turn to page 13, please. And 18187, just to remind everyone, is a Dr. Rodgman memorandum, "THE SMOKING -- A CRITICAL AND OBJECTIVE APPRAISAL OF

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THE SMOKING AND HEALTH PROBLEM." Do see that?
A. Yes, sir.
Q. Could you turn to page 13 of that document, please.
A. Okay.
Q. I want you to assume there has been some testimony earlier in this case with respect to some of the statements on page 13, and I'd like to ask you this question. It says, "Members of the Research Department -- this Research Department studied in detail cigarette smoke composition," then a number of citations; correct?
A. Yes.
Q. Then it goes on to say "Some of the findings have been published," more citations. Then, "However, much data remain unpublished because they are concerned with carcinogenic or cocarcinogenic compounds." Do you see that?
A. I see that.
Q. After you reviewed this memorandum, did you check the citations there to see whether that

information was or was not in the scientific literature?
A. After I saw this statement on page 13, I did go back to each of the references cited there after that phrase "much of the data remains unpublished because they're concerned with carcinogenic or cocarcinogenic compounds," I think there's something like 17 different references, or thereabouts. What I found was that there were some papers in that group of references that speak to identification of constituents in smoke, particularly polycyclic aromatic hydrocarbons and a class of compounds called phenols. There were also a number of --
A number of these references dealt with attempts to find out how -- or the precursors to the formation of polycyclic aromatic hydrocarbons, what those precursors are and how polycyclics could be formed. So it was more of a basic research study. Some of these references also dealt with analytical -- development of analytical test methods. Some of these references also dealt with attempts at selective reduction through certain filter additives. So there was some information there that did speak to -- to identification of constituents. And a lot of these references deals with things other than

that, including some proprietary or patentable information like a selective filtration attempts.
Q. Now if you could turn to page six, please.
MR. CIRESI: Excuse me, excuse me, counsel. Could we have when that was cited, that -- that document?
MR. WEBER: The transcript reference?
MR. CIRESI: No, no, the document, when that was given notice of. Which letter?

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MR. WEBER: I'm not sure which letter, whether it's in our letter or yours.
MR. CIRESI: Oh, no, no, the one that you gave notice of, 18187. Can you tell us?
MR. WEBER: You want --
Does Your Honor want that issue addressed now, or --
MR. CIRESI: Yes. Because I don't believe it was -- notice was given of that document. I just want to know which one. I may be mistaken.
MR. WEBER: It was designated by the plaintiffs, that's why.
MR. CIRESI: Oh. So you did not designate that document.
MR. WEBER: No. We did it after you designated it.

MR. CIRESI: May we have, then, Your Honor, the foundation for the statements just made by the witness, what he did, where he looked? Otherwise I'm going to move to strike that. There was no notice given on this document by the defense.
MR. WEBER: Your Honor, the parties have through their designation process a number of times used documents designated by the other side in this. This is a -- this is a red herring issue in the extreme.
MR. CIRESI: Only when we say we're going to use that. That's the rule. Now all I want is the foundation for the doctor's testimony as to what he did, where he looked, which documents he looked at.
THE COURT: Well we'll give you a chance to cross-examine him on that, counsel.
MR. CIRESI: All right.
BY MR. WEBER:
Q. Now Dr. Townsend, could you turn to page six of this document.
A. Yes.
Q. And is there a footnote there?
A. There is. And --
Q. Could you deal with the significance of that footnote and the text to which it refers.

A. I'll be happy to.
I said as I looked at the references that are referred to on page 13, some of those references did refer to the identification of polycyclic aromatic hydrocarbons. In looking through those constituents I found that -- and -- and referring back to the entire memo and reading the entire memo thoroughly, I found that Dr. Rodgman on page six did refer to every one of those polycyclics as being previously reported by Davies. And that's reference 27, it's on the -- it's -- and it's referred to in the footnote at page six. He says, "This author discusses all the polycyclic hydrocarbons except cholanthrene."
I dug a little further and found that Dr.

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Rodgman in fact presented the identification of cholanthrene at an American Chemical Society meeting in Atlanta a few years later.

There was another group of compounds referred to in the identification back on page 13, and those were phenols. All of the constituents that were phenols that were reported were also previously identified, mostly by Van Duuren, except for two, and there were two compounds that Dr. Rodgman identified for the first time and it was eugenol and iso-eugenol. I found, after digging a little further, that Dr.

Rodgman did in fact publish that in the peer-reviewed journal in 1964, two years after this memo. He also presented it at a Tobacco Chemists Research Conference in 1964.

Q. Now let's return, Dr. Townsend, to selective reduction, and could you turn to tab 13, Exhibit 2386.

A. Yes.

Q. And let me ask you whether that's a chart that would assist your testimony regarding the selective reduction technique?

A. It is.

MR. WEBER: Your Honor, I would move X2386 for demonstrative purposes.

MR. CIRESI: No objection, Your Honor.

THE COURT: Court will receive X2386 for demonstrative -- for illustrative purposes.

BY MR. WEBER:

Q. Now Dr. Townsend, does this chart relate to techniques of lowered or reduced BaP by R. J. Reynolds?

A. Yes, it does.

Q. Could you start at the top and discuss each of these briefly.

A. I'll be happy to. And before I start it, let me

say that if -- if one wants to -- to determine or identify ways to reduce or eliminate benzpyrene, there are really two general approaches that can be taken. First of all, benzpyrene is not present in tobacco in any appreciable quantities. It's generated when the tobacco burns. So one approach to reducing benzpyrene may be to prevent the formation of benzpyrene, somehow interrupt that synthesis, that pyrosynthesis. Another approach could be to selectively remove it after it's formed. These different techniques here speak to one or the other.

The first is the use of tobacco additives, and again that's to the former case, to prevent the formation of benzpyrene. What we thought, and -- and actually still think about the mechanism of formation, is that -- is that when tobacco's burned, there are free radicals generated and cyclized to form this polycyclic aromatic hydrocarbon, and if we could somehow stop that cyclation, we could reduce

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the level of benzpyrene. Reynolds, and I think a number of other tobacco companies and others outside the industry, have looked at a variety of metal nitrates including palladium, platinum, magnesium, manganese, other oxides, to try to change the burning temperature of the cigarette and reduce the extent of

this cyclization reaction. So there have been a variety of tobacco additives examined.

Q. Are there issues raised by the addition of metal additives to cigarettes?

A. Well I think there are a number of issues. Some metals, for example, might form carbonyls and -- and are -- are reasonably volatile and can be delivered in the smoke as -- as metal carbonyls, which for some metals those compounds are of -- are quite toxic. I think there are a number of issues. There are also some issues with the anion as well; for example, nitrate can decompose and form a lot of nitric oxide, among other things.

The second approach is different filter materials, and again that's allowing the benzpyrene to form and then somehow, through the use of alternate filters, try to selectively remove it from the smoke.

The third approach is to use different filter additives. If we took a conventional cigarette filter and placed some compound or chemical in the filter that can selectively absorb benzpyrene, that might be another approach. Now we thought that it was -- I think scientists at the time, back in the '50s, thought that was a pretty good approach. I

think they didn't understand the dynamic nature of cigarette smoke to the extent that we know now today, because benzpyrene and most other polycyclics are not volatile, and so the use of filter additives or alternate filter materials doesn't necessarily or won't necessarily effect a selective reduction.

The use of different cigarette papers to prevent the formation, turns out that examination of more-porous cigarette papers did have a small influence on the benzpyrene yield, and part of that was because of another technique called air dilution, which we'll talk about later.

And then finally tobacco extraction. Since benzpyrene is formed during the burning of the tobacco, the question is, well, what are the precursors that, when heated, form benzpyrene? Scientists at Reynolds and -- and at other laboratories have looked extensively using radiotracers, done extensive radiotracer studies to try to define what those precursors are. We did find that, as a result of -- of our work, that long-chain hydrocarbons, waxes, and in particular solanesol and others, are precursors to benzpyrene formation. So the idea with extraction is to -- is to use solvents

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to try to extract those precursors, reduce the level of precursors, so that when the tobacco burns, you don't generate as much benzpyrene.

Q. Did Reynolds undertake work to attempt to develop an extraction process which could be commercialized?

A. We did. We conducted extensive work on the extraction approach.

Q. Did extraction in the end work?

A. Technically it did. We found that once we had extracted tobaccos with solvents, and we looked at a lot of different solvents, we found that the -- and -- and made cigarettes with the extracted tobacco, we found that the level of benzpyrene was in fact lower. So technically it worked. Practically, there were a number of issues, number of problems.

Q. Could you identify those for us.

A. Well there were -- there were several. The first is these extracted tobaccos were really quite fragile, and it was very difficult to make a -- make them into a tobacco rod because they would break apart, they were so fragile.

Another reason, and -- and one of the most important reasons, is that the taste characteristics of those cigarettes were really quite, quite different. We believed that they had a very

unacceptable taste characteristic.

Another reason is that we found, when we actually did detailed smoke chemistry on these -- on these cigarettes, we did in fact find benzpyrene was down, but we also found that some other constituents like phenols were elevated as a result of this extraction. So it was -- it was an unintended consequence of the extraction, really.

And then we also had a difficult time removing the -- the solvent from the tobacco. There were still fairly high levels of solvent in the extracted tobacco.

Q. Were Dr. Wynder and others outside the tobacco industry working on extraction as well?

A. They were. A number of scientists were, outside the industry.

Q. Was the scientific experience of others outside the industry such as Dr. Wynder different from the experience at R. J. Reynolds with respect to the extraction process?

A. No, I think their experience was just as ours.

Q. Did the Surgeon General later express an opinion regarding whether or not extraction was a practical or realistic method?

A. He did. In the 1979 report the Surgeon General

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indicated that extraction of tobaccos to reduce benzpyrene was of academic interest only.
Q. Did there come a time when Dr. Wynder and others began to express doubts about the practical significance of the BaP theory?
A. That's correct. In -- in the late '50s, Dr. Wynder and -- and some other scientists began questioning whether benzpyrene was the problem with cigarette smoke, and in particular Dr. Wynder expressed that once we had identified the level --
MR. CIRESI: Excuse me, Your Honor, I'm going to object to the hearsay on the part of this witness.
MR. WEBER: If I just may be heard, it's not hearsay, Your Honor, it's for statements in the literature and the effect on the research and development issue.
THE COURT: Then you better refer to the literature.
MR. WEBER: All right.
BY MR. WEBER:
Q. Could you turn to tab 16, Exhibit CE000084.
A. Yes, sir.
Q. Is that an article by Dr. Ernst Wynder called "TOWARDS A SOLUTION OF THE TOBACCO-CANCER PROBLEM,"

published in January 1957 in the British Medical Journal?
A. It is.
Q. Do you rely upon this article regarding the significance of the amount of BaP in tar and regarding selective reduction of BaP?
A. Yes.
MR. WEBER: Your Honor, I'd move the admission of that under 803(18).
MR. CIRESI: No objection, Your Honor.
BY MR. WEBER:
Q. Now if you could turn to tab 17, Dr. Townsend, is that a blown-up quote from Dr. Wynder's article?
A. Yes, it is.
Q. And that is Exhibit 238 -- X2388.
MR. WEBER: Your Honor -- oh, I'm sorry, I wasn't looking. I'm sorry.
THE COURT: I'm sorry, I'm having trouble with the mike up here. I'm trying to resolve it.
MR. WEBER: Okay.
THE COURT: Can you wait just a moment?
MR. WEBER: I'm sorry, I didn't notice you were talking.
THE COURT: I just want to make sure the record reflect CE000084 is admitted into evidence.

Go ahead, counsel.
MR. WEBER: Okay. Your Honor, let me start this again because I may have been looking at my exhibits, --
THE COURT: Go ahead.

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MR. WEBER: -- missed -- missed the fact that you were consulting with the clerk.
THE COURT: No, I think that was my fault.
MR. WEBER: Well I should have been paying better attention.
BY MR. WEBER:
Q. At X2388 at tab 17, is that a quote that you have blown up from Mr. Wynder's article that was just admitted into evidence?
A. Yes, it is.
MR. WEBER: Your Honor, I'd move X2388 for demonstrative purposes.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive X22 -- 2388, 2388, for illustrative purposes.
BY MR. WEBER:
Q. All right. And is that --
Could you read that quote from Dr. Wynder's article.
A. Yes. And this is, again, from the British

Medical Journal 1957. Dr. Wynder says, "The benzopyrene content of cigarette tar is not more than 2 parts per million, which, according to our experiments is not sufficient to produce the type of activity noted in our animals painted with tobacco tar."
Q. Dr. Townsend, could you turn to the right and find the 1964 Surgeon General's report. Not in -- not in the binder there. I think it's on the shelf there. That is in evidence as PX3825.
A. The 1964?
Q. Should be up there.
A. Okay. I see it.
Q. And could you turn to page 144.
A. Okay. I'm there.
Q. And could you read this paragraph going over to the next page.
A. Yes. It's at the bottom of the page.
Q. And just for the record, it's from page 144 and 145 of the 1964 Surgeon General's report.
A. "Tobacco smoke contains many carcinogenic polycyclic aromatic hydrocarbons, parenthesis, (Table 2, Chapter 6). Benzo(a)pyrene is present in much larger concentrations than is any other carcinogenic polycyclic hydrocarbon. The inability to account for

the carcinogenicity of the tobacco products, except to a very minor degree, by the amount of benzo(a)pyrene present was unanticipated. Both Druckrey (reference 92) and Wynder (reference 372) emphasized that the benzo(a)pyrene concentration of various tobacco and smoke preparations is only sufficient to account for a very small part of the carcinogenic -- carcinogenicity of these materials. One hypothesis suggests that promoting agents present in tobacco and tobacco smoke, such as various

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phenols, enhance the potency of the carcinogenic hydrocarbons so as to account for the biological activity of the tobacco products. Further, possible synergism between low levels of the several known carcinogens in the tobacco condensates and extracts may also enhance the carcinogenic potency."
Q. Now, it refers there to a hypothesis that might involve chemicals called phenols; correct?
A. That's correct.
Q. Did R. J. Reynolds begin work examining the hypothesis with respect to phenols?
A. We certainly did. And -- and again, the -- the hypothesis is that if there's insufficient benzpyrene and polycyclic aromatic hydrocarbons to account for the mouse skin-painting results, then there must be

some other cocarcinogens or promoters that will enhance the activity so that together they may account for the mouse skin-painting results.
We did, in fact, evaluate that hypothesis very thoroughly, went in and tried to determine if there are phenols present in the smoke. And there are a number of phenols. We tried to identify or -- identify those, quantitate or determine how much of those phenols were present, and then sought ways to reduce or eliminate those phenols.
Q. Now are phenols chemicals that are unique to cigarette smoke, Dr. Townsend?
A. No, they are not. They are in a variety of naturally-occurring materials: fruits, vegetables. Phenols are also used in a number of consumer products like Chloroseptic and throat lozenges and a number of things.
Q. Now at what levels did R. J. Reynolds find phenols in cigarette smoke?
A. Well there -- there are varying levels. There are -- there are a few phenols that are present in the microgram-per-cigarette range, so that would be a millionth of -- a millionth of a gram per cigarette; there are a number of phenols that are present in the nanogram range, again, a billionth of a gram per

cigarette.
Q. Can you describe for us what techniques to selectively reduce phenols were examined at R. J. Reynolds, some of the major efforts.
A. I think -- I'd be happy to. I think we -- we approached the phenol reduction in very much the same way as we did the benzpyrene. We tried to understand how phenols were generated. We conducted some basic research using radiotracers to try to determine what the precursors are, and we found that lignin, the natural backbone of the tobacco, biopolymers like lignin, were the precursors or most of the precursors. We tried to extract or somehow prevent the formation of phenol. We looked at filter additives, we looked at special types of filters; we

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looked at tobacco additives, again, placing a number of constituents on the tobacco to try to interrupt the formation of -- of phenols. So we pretty much followed the same -- the same approach that we did for benzpyrene.
Q. Did any of the techniques that you investigated meet with success with regard to reducing phenols?
A. I think there was -- there was some success. What we found is the more volatile phenols can be selectively removed by -- by filters if the filters

are made from cellulose acetate. The -- the selective removal of phenols is also enhanced if the cellulose acetate filters are plasticized with certain polar compounds, like triacetin, or in the case of one of our competitors, they used carbowax. So I think there were -- selective filtration of the more volatile phenols certainly was accomplished, at least to a degree.
Q. Now once --
If once you discovered that filters of cellulose acetate particularly treated with triacetin or carbowax, could selectively reduce these phenols, did you incorporate that -- did Reynolds incorporate that into its product?
A. Well it was already in the products in the market. It was sort of after the fact. These -- these techniques or these construction variables were in the market. After the fact we learned that they did selectively reduce phenols, the volatile phenols. I'm --
Q. Now did there come a time when the scientific community began to raise doubts about the phenol hypothesis that was expressed in the 1964 Surgeon General's report we just referenced?
MR. CIRESI: Object to the form of the

question. There's no foundation.
THE COURT: You may answer that.
A. I think there was a time, certainly, that the scientific community began questioning this -- this theory, and that's again the initiation by polycyclics and the promotion by phenols. And there -- there were a number of major questions, one is that scientists were beginning to learn that some phenols were thought to be tumor inhibitors, not promoters. They also found that phenols in fact are very water soluble and are -- are actually absorbed fairly rapidly in the oral cavity. And so there's -- there's a lot of -- there was a lot of questions about the theory at the time.
Q. Could you turn to tab 19, which is Exhibit AZ000804. Do you have that, doctor?
A. Yes.
Q. Can you identify that as an article from the Journal of the National Cancer Institute in 1971 by Van Duuren, et al?

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A. It is. This is an article by Van Duuren.
Q. And the Journal of the National Cancer Institute is a highly respected journal?
A. Yes, it is.
Q. And is this article one on which you rely with

respect to information, which you and others reasonably rely, with respect to information regarding phenols and cigarette chemistry?
A. Yes.
MR. WEBER: Your Honor, I'd move the admission under 803(18) of AZ000804.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive AZ000804.
BY MR. WEBER:
Q. Now, could you start out on page 236 of that --
Let me show the title page first, if I could, doctor, article entitled "Cigarette Smoke Carcinogenesis: Importance of Tumor Promoters;" correct?
A. Yes.
Q. And these are by scientists at NYU?
A. Yes.
Q. Now if you could go to the second page, upper left-hand column, and read that first full sentence starting at the top of the second page.
A. Beginning with "These experiments...?"
Q. Yes.
A. "These experiments convinced us that tobacco tar is primarily a tumor-promoting agent and that the role of benzo(a)pyrene," also known as Ba -- or

sorry, "paren, (BaP), as well as other carcinogenic hydrocarbons acting as cocarcinogens and/or initiators, is not necessarily of prime importance in tobacco carcinogenesis."
Q. Now could you turn in this same article to page 239, Dr. Townsend. I'd like you to read that first paragraph under "DISCUSSION."
A. Okay. "Although carcinogens, cocarcinogens, and tumor-inhibitory agents in cigarette smoke condensate have been studied extensively, the chemicals responsible for the known mouse skin carcinogenicity of tobacco tars remain largely unknown. This is mainly due to the complex chemical nature of tobacco tars, the resultant effects of one type of agent on another, and the possibility that a single chemical can have multiple biological effects. Earlier, (reference 12) we showed that some noncarcinogenic or weakly carcinogenic aromatic hydrocarbons which are cigarette smoke components can function as initiating agents in two-stage carcinogenesis. These agents were earlier regarded as irrelevant in tobacco carcinogenesis. We have also found that phenol, which is a weak tumor-promoting agent, is indeed an inhibitor of tumorigenesis when applied simultaneously with BaP; another example is the

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otherwise biologically inactive tobacco component, rutin, which is also an inhibitor for BaP carcinogenesis in mouse skin (reference 13). The experiments described in this report were carried out to unravel some of these effects."

Q. Now, let me take you back to that sentence down at the lower left-hand column which said that "we have also found that phenol, which is a weak tumor-producing agent -- promoting agent, is indeed an inhibitor of tumorigenesis when applied simultaneously with BaP." What does it mean to be an inhibitor of tumorigenesis?

MR. CIRESI: Excuse me, Your Honor, there's no foundation for this witness to testify to that. He's not here to testify on biological implications.

MR. WEBER: I can ask it chemically if you want, Your Honor.

BY MR. WEBER:

Q. From the chemical standpoint, what does it mean for one chemical to be an inhibitor of the effect of another?

A. A chemical that's an inhibitor would reduce the effect or activity of another chemical.

Q. And is this one of the scientific articles that you referred to earlier when you said the phenol

hypothesis had come into question?

A. Yes.

Q. Now Dr. Townsend, did there come a time when a theory regarding the effects of smoke causing ciliastasis became the focus of attention in selective reduction research?

A. Yes, there was. In the early '60s the ciliastasis theory started gaining importance among some in the scientific community.

Q. And what was the approach of the Reynolds R&D department to the ciliastasis theory?

A. Well again, we looked at the theory very seriously, we listened to the scientific community and in fact interacted with members of the scientific community to thoroughly understand the theory and see what we could do about addressing that smoking and health theory.

Let me back up and maybe explain what -- what ciliastasis is. That may help. Ciliastasis -- well let me back up. In -- in the upper respiratory tract there are cilia.

MR. CIRESI: Excuse me, doctor. Your Honor, there's no foundation for this witness to testify on biological implications. In fact he's testified he doesn't have any expertise in that area.

THE COURT: Well I think he can define what

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ciliastasis is.
A. In the upper respiratory tract there are hair-like projections that are called cilia. The theory is that there's some constituents in smoke that may inactivate or stop the motion of these cilia. What the cilia do is they pretty much beat in unison to provide a major clearance mechanism for the upper respiratory tract. The theory then is that some constituents in smoke would stop that movement of the cilia, would reduce or eliminate that mechanism of clearance, and so that smokers would be exposed more to the effects of tar. So that was the theory.

We at Reynolds again, as -- as we did in the other theories, tried to determine if ciliastats were present in smoke, and we found a number are. We also determined the levels of those ciliastats in smoke, and then we sought ways to reduce or eliminate those ciliastats.

Q. What levels were the ciliastats present at?
A. Well there's a wide range. Some of the ciliastats are present in the -- in the microgram range; for example, certain aldehydes and ketones present in the microgram range, which is a millionth

of a gram. Some ciliastats are present in the -- in the nanogram range and less.
Q. Did Reynolds and other companies find a technique that addressed the selective reduction of ciliastats?
A. Yes.
Q. Could you describe that.
A. There was a technique actually discovered in the '60s -- or we discovered that the use of carbon filters, or carbon particles placed in filters, or some carbon materials in filters, could selectively remove some of the ciliastats from cigarette smoke.
Q. And how did --

Were carbon or carbonized filters put into the marketplace by Reynolds and its competitors?
A. They were. In the -- in the early '60s there were a number of cigarettes that used carbon filters to reduce these ciliastats. For example, I think one of my competitors introduced a product called Lark in roughly 1962 which gained a very sharp increase in share of the market, up to a couple percent. R. J. Reynolds introduced a product in 1964 called Tempo with a carbon filter. It wasn't quite as successful, unfortunately, as my competitor's. It went up only a -- less than a percent. And then over the next

number of years the overall market share of carbon filter products tended to tail off. But there was a sharp increase in the interest among consumers for carbon filter products.
Q. Was the increase -- did it occur shortly after an article in the Reader's Digest about carbon

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filters and ciliastats?
A. Yes, it did. There was an article in Reader's Digest referring to the ciliastasis and ciliastats in smoke and suggested to readers that carbon filters could remove some of the ciliastats.
Q. How did carbon filter cigarettes do in the marketplace, Dr. Townsend?
A. Well as I've already said, they -- the market share didn't last. Over the next number of years market share trailed to almost nothing, and one of the main reasons is that the smoke from carbon-filtered cigarettes tastes different. It really -- the carbon -- the carbon in the filter removes constituents which changes the taste characteristics of the smoke, and many smokers didn't accept that taste.
MR. CIRESI: Your Honor, I'm going to move to strike the non-responsive portion. There's no foundation for him in marketing.

MR. WEBER: Your Honor, if I may, all --
He spoke earlier on Friday about the importance of following market data, not in marketing but following market data as to consumer acceptance of products. That's all I'm going into now.
MR. CIRESI: Well Your Honor, then I'd like some foundation in light of the previous testimony this gentleman has given as to what he's relying on for those statements.
THE COURT: All right. I don't know if he's going to start giving us information regarding the rejection by smokers, I don't think -- I think he's getting a little beyond his expertise.
MR. WEBER: Let me ask -- I'm sorry.
THE COURT: Just as to the last sentence, that will be stricken. The balance of his answer may stand.
BY MR. WEBER:
Q. Let me ask the last --
Or let me ask this question: What lessons did R. J. Reynolds draw regarding the failure of charcoal filtered cigarettes in the marketplace?
A. As a product developer and a cigarette design scientist for R. J. Reynolds, it was clear to me that the company learned that -- that consumer acceptance

of modified products is essential in the marketplace.
MR. CIRESI: Well, Your Honor, again there's no foundation with respect to how they marketed this or anything else in light of his previous testimony. I'm going to move to strike that.
THE COURT: Well the answer will stand. I'll give you a chance to cross-examine on that issue.
BY MR. WEBER:
Q. Now did there come a time when the underpinnings

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of the ciliastasis theory came into question?
A. I think there were a number of questions about the ciliastasis theory from scientists in a number of countries, yes.
Q. And did some of those questions relate to whether or not the ciliastats reached down into the airways?
A. Yes. If --
MR. CIRESI: Excuse me, doctor. Your Honor, counsel is continuously leading, and we're into the opinions of this gentleman. I'd ask that he have non-leading questions.
THE COURT: I think that maybe at this point you should start changing your phraseology.

BY MR. WEBER:
Q. Can you explain what some of those questions were regarding the cilia -- the underpinnings of the ciliastasis theory.
A. I'll be happy to.
If you recall the ciliastasis theory, the cilia reside primarily in the upper respiratory tract. This -- the questions that some scientists had when they found out which ciliastats were present in smoke and the levels that they were present in smoke was do they actually get to where the cilia are in the first place, because many of these constituents in smoke that are thought to be ciliastats are water soluble. And they found -- in fact a Swedish research group, and we confirmed that at Reynolds and a number of other researchers had found that absorption of many of the ciliastats in the oral cavity prevented them getting to -- to a large extent to where the cilia are in the first place.
Q. Now were there other theories that -- with respect to other compounds or groups of compounds that R. J. Reynolds investigated under a selective reduction approach?
A. There have been a number of theories that Reynolds has investigated selective reduction

approaches for.
Q. Does Reynolds still investigate the selective reduction approach?
A. Yes, we do.
Q. Based on your background in cigarette design and your review of the R. J. Reynolds research and development matters we've talked about, was there ever a time during the '50s and '70s when Reynolds believed there was a sustained scientific consensus regarding just what specific compound should be the focus of selective reduction?
MR. CIRESI: Your Honor, I'm going to object to the form of the question with regard to Reynolds. If he's asking his opinion, it's a different story.
THE COURT: Ask him his opinion, counsel.

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BY MR. WEBER:
Q. Do you have an opinion as to whether -- an opinion based on your time while at Reynolds, the work you've done for 20 years and the work you've described for us on Friday, as to whether there was ever a time in the '50s to '70s when there was a sustained scientific consensus regarding just what specific compound should be the focus of selective reduction engineering?

A. There's never been a sustained consensus in the scientific community about what compound or compounds ought to be removed from cigarette smoke. As scientists developed new theories, I think new targets were placed on the table. So initially it was benzpyrene, then some scientists started questioning that, proposed additional targets. So there have been multiple targets. But I don't think there's been a sustained scientific consensus on what in cigarette smoke needs to be removed.
Q. Now could you turn to tab -- back to tab four there, which is already in evidence, GJ10043, and that's the Wynder and Hoffmann book, "TOBACCO AND TOBACCO SMOKE" from 1967.
A. Yes.
Q. And could you turn to page 526, and I want to ask you whether Wynder and Hoffmann made a recommendation on page 526 in "TOBACCO AND TOBACCO SMOKE" in 1967 about nitrates in tobacco processing? And it would be one, two, three -- middle of the fourth paragraph.
A. I almost need a magnifying glass. I'm sorry, the bifocals don't work too well.
Q. Can you find it?
A. I -- I'm fine.

Q. Second sentence -- third --
Second sentence of that fourth paragraph.
A. Beginning with "Combining...?"
Q. Yes. Could you read that.
A. Yes. "Combining the advantages of high-nitrate tobaccos and additions of stems to cigarette tobaccos, one would expect an optimal 'tar' and tumorigenicity reduction in using stems of Burley tobaccos as proportional additions."
Q. Now, if you could turn at this point to tab 14, I want to ask whether that's a later article by Dr. Hoffmann entitled --
MR. WEBER: I'm sorry, Mr. Ciresi, that's AZ0001117.
Q. Is that a later article by Dr. Hoffmann entitled "Formation and Analysis of N-Nitrosamines in Tobacco Products and their Endogenous Formation" in Consumersm, published by the World Health Organization in 1984?
A. That's correct.
Q. Is that an article that you have reviewed and

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relied upon in connection with cigarette chemistry and design techniques?
A. Yes.
MR. WEBER: Your Honor, I'd move the

admission under 803(18) of AZ001117.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive AZ001117.
BY MR. WEBER:
Q. Now, did this article include a comment about high nitrates or low nitrates in cigarettes?
A. Yes, it did.
Q. Would you turn now to tab -- your next tab, Dr. Townsend, which is tab 15, that's X1858A, and does that compare a quote from the Wynder Hoffmann article on high nitrates that you read earlier to the jury from their '67 book with a quote from Dr. Hoffmann from his 1984 article that we just referenced?
A. Yes, it does.
MR. WEBER: Your Honor, I'd move the admission for demonstrative purposes of X1858A.
MR. CIRESI: Well there's editorial comment on this exhibit, Your Honor, it's not just quotations from the article.
MR. WEBER: It's a demonstrative exhibit, Your Honor.
MR. CIRESI: Well it's argument. I have no objection to the quotations, but apparently they're putting argument on their demonstrative exhibits.
MR. WEBER: Your Honor, both sides have

added titles to their demonstratives.
THE COURT: Well this is --
Can you just block that copy, that statement off, and just quote it as it should be quoted?
MR. WEBER: Okay.
BY MR. WEBER:
Q. All right. On the left, could you -- that's the quote you read earlier from Wynder and Hoffmann in 1967 talking about advantages of high-nitrate tobaccos --
A. That's right.
Q. -- that one would expect to reduce tumorigenicity?
A. That's right.
Q. Now on the right, what does Dr. Hoffmann say in 1984?
A. In the 1984 article Dr. Hoffmann said, "This trend to increase nitrate levels by using ribs and stems should be reversed or counteracted by selecting stems with lower nitrate content or by reducing the nitrate content of the stems by special fermentation processes, extractions or by other means."
Q. And what's the significance to you as one in the cigarette design field with respect to these two recommendations from the Wynder Hoffmann group?

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A. The significance to me is it points out the difficulties in cigarette design in addressing these -- these multiple targets that had been placed on the table, that the scientific community, I think, sincerely is looking towards. For example, Wynder is suggesting the use of nitrates to lower tumorigenicity, but then on the other hand he a number of years later suggests that the other direction is the preferred route because of yet another theory.
Q. On this same subject of selective reductions, is there other literature of which you're aware that indicates the difficulties with selective engineering?
A. Yes, sir.
Q. Could you turn to tab 25, and that's GJ000107, and let me ask you if you can identify that as a book called "Banbury Report 3, A SAFE CIGARETTE, question mark," edited in 1980 by Gori and Bock?
A. That's what it says, sir.
Q. Is that a book that you became familiar with in the regular course of your business at R. J. Reynolds?
A. Yes.
Q. Is it a book on which you and others interested

in cigarette chemistry and design reasonably rely?
A. Yes.
MR. WEBER: Your Honor, I'd move the admission under 803(18) of GJ000107.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive GJ000187.
MR. WEBER: Judge, I may have misheard you. I think it's 107.
THE COURT: Should be 107. If I said 187, it should be 107.
MR. WEBER: Thank you, Your Honor.
BY MR. WEBER:
Q. Could you turn to page 355 in the Banbury Report 3 that was just admitted, and I'd like you to --
This is from 1980; correct, Dr. Townsend?
A. Yes, sir.
Q. And I'd like you to read this last full paragraph on page 355.
A. The last full paragraph?
Q. Yes, sir. The one that begins with --
A. With "Uncertainty...?"
Q. -- "uncertainty...."
A. Yes. "Uncertainty about the specific attribution of risks to individual smoke components may be greater than ever now, perhaps with the

exception of some fractions that have shown carcinogenic activity in animals. Hence it has been

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difficult to provide a rational -- a rationale for deliberate reductions of specific components of smoke, aside from the self-fulfilling claims that the reduction of one or the other component may lead to reduced risk. Additionally, if one recognizes the genuine difficulties in selectively removing specific smoke components, it is not surprising that the most practical solution is to reduce total smoke emission and therefore all smoke components, and then to return to specific components that are considered harmless and would restore desirable characteristics of acceptability."

Q. What's the significance of that statement in 1980, the Banbury report, to you as a cigarette designer, Dr. Townsend?

A. To me as a cigarette designer it makes it clear that Dr. Gori, as well as others in the scientific community, have recognized that selective reduction has major limitations, that it's extremely difficult, and that overall reduction -- reduction of total smoke is an attractive way to go.

MR. WEBER: Your Honor, I'm going to move to another large topic. I don't know if now would be

appropriate.

THE COURT: Why don't we take a recess.

THE CLERK: Court stands in recess.

(Recess taken.)

THE CLERK: All rise. Court is again in session.

(Jury enters the courtroom.)

THE CLERK: Please be seated.

THE COURT: Counsel.

MR. WEBER: Thank you, Your Honor. Am I -- yeah. Thank you, Your Honor.

BY MR. WEBER:

Q. Dr. Townsend, let's move now to a discussion of the general reduction engineering.

A. Yes, sir.

Q. When did Reynolds begin exploring the principles of general reduction?

A. Reynolds began exploring the general reduction techniques and -- and the whole approach of general reduction in the early '50s, about the same time we began exploring selective reduction.

Q. Was Reynolds the only tobacco company exploring general reduction techniques?

A. No. I believe that all my competitors in the United States were simultaneously exploring general

reduction techniques.

Q. You spoke on Friday about the differences and explained the differences between the selective reduction and general reduction techniques. What I'd like you to do now is turn to tab 26, which is X2567, and let me ask you if that's a chart that would assist you in your testimony explaining the

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advantages of general reduction?
A. Yes, it is.
MR. WEBER: Your Honor, I'd move X2567 for demonstrative purposes.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive X2767 for illustrative purposes.
MR. WEBER: Your Honor, I think it's 2567.
THE COURT: 2567?
MR. WEBER: Yes, sir.
THE COURT: What tab number is it?
MR. WEBER: X2567.
THE COURT: What's the tab number?
MR. WEBER: Oh, I'm sorry. Tab 26 on my note. Did I --
THE COURT: I thought you said tab 27.
MR. WEBER: I'm sorry.
THE COURT: All right. Under tab 26 it's

X2567.
MR. WEBER: Thank you, Your Honor.
BY MR. WEBER:
Q. Dr. Townsend, could you go through this chart and explain what you understand to be the advantages that -- advantages of the general reduction approach for the ladies and gentlemen of the jury.
A. Yes, I will. And let me remind -- remind you that general reduction is the overall reduction of all the constituents in smoke more or less to the same degree.
We found that the advantages of general reduction are really very technically practical. Unlike the technical difficulties we found in selective reduction, we found general reduction is quite practical technically. Of course general reduction, reducing all the constituents more or less to the same degree, you address all the potential problematic compounds, so you -- so you don't have the problem we had in selective reduction -- or have in selective reduction with changing targets or -- or additional targets and -- and additional theories being considered by the scientific community.
General reduction, because all the constituents pretty much come down to the same degree, more or

less, you avoid the unintended consequences like the one we found in benzpyrene where we did effect a reduction in benzpyrene through extraction, but we found that phenols went up. With general reduction, everything comes down pretty much to the same degree.
And then finally, one of the big advantages of general reduction is that you maintain the overall taste characteristics or the balance of the smoke. You're not going in and removing one compound or one class of compounds like the carbon filters did and upsetting the balance of the smoke. The balance stays pretty much the same.

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Through general reduction, the intensity of the taste will go down because there's less tar and less nicotine, so the intensity will go down, but the balance stays more or less the same.
Q. Could you turn to tab 27, which is X2767, and let me ask whether that's a chart that's been prepared to help you explain general reduction techniques?
A. Yes, it is.
MR. WEBER: Your Honor, I'd move the admission of X2767 for demonstrative purposes.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive X2767.

BY MR. WEBER:
Q. Now, Dr. Townsend, could you go through this chart just briefly, because some of these we'll come back and touch on in some more detail, but explain some of these general reduction techniques.
A. Yes, I will.
If you start at the left-hand corner of this -- this exhibit, it's indicated that reconstituted tobacco is a general reduction technique. Reconstituted tobacco is a -- is a paper sheet made of tobacco, and we will talk about that more.
The use of filters, to the middle on the left-hand side, of course, obviously, is a -- is a way to reduce all the smoke constituents. So filtration, and in particular highly efficient filters, is -- is a powerful -- a major technique and -- and very effective.
The use of porous papers, down at the bottom left-hand corner, porous papers increase the level of air dilution admitted to the cigarette, and we'll talk about that as well.
In the top right-hand corner, filter ventilation is -- is a very, very important technique for general reduction.
Next down, faster burning papers, essentially

what that is is -- is by choosing and -- and identifying cigarette papers that will burn faster, the puff count or number of puffs taken on the cigarette will be reduced, and that's a means for -- for general reduction as well.
Then expanded tobacco, and that's essentially a means for burning less tobacco when a cigarette is smoked, and we'll talk about that just briefly.
And then finally at the bottom right-hand corner, reducing the amount of tobacco burned through a number of means, including making the circumference of the cigarette smaller, that will reduce the amount of tobacco burned. Making the tobacco rod shorter, that will reduce the amount of tobacco rod -- amount of tobacco burned. And then another technique is to adjust cigarette makers so the cigarette makers actually pack a little bit less tobacco in there,

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again to reduce the amount of tobacco burned.
Q. Dr. Townsend, let's start with the issue of filtration, and if you could turn to tab 28, X2488, is that a demonstrative that will help you explain filter -- filtration and filter modification?
A. Yes.
MR. WEBER: Your Honor, I'd move X2488 for demonstrative purposes.

MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive X2488.
MR. WEBER: Your Honor, may I have the court's permission for Dr. Townsend to come down and illustrate this board?
THE COURT: Go ahead.
BY MR. WEBER:
Q. Now Dr. Townsend, using demonstrative Exhibit X2488, could you explain how a cigarette filter -- what are different modifications and the purposes.
A. Right. These -- these are some of the filter modifications that I tried to indicate on this exhibit. First of all, cigarette filters obviously trap the particles, the particulate phase in smoke, those little droplets that we talked about Friday, and this just represents the particles trapped on the surface of a bundle of fibers.
Obviously, one can make a cigarette with different materials. Most of the cigarettes sold in the United States are fiber bundles made of cellulose acetate. The cellulose comes from wood pulp. It's acetylated and then spun into fibers. We've also used commercially paper filters, a lot like crepe paper, that's folded and gathered and formed into a rod for filters. We've also looked at a number of

alternative materials like polypropylene, polyethylene, and also a number of very different materials for selective reduction as we talked about earlier. But nevertheless, the choice of the materials can affect general reduction.
Also, probably most people think that these little fibers in the cigarette filter are round. They can be, and some cigarettes have used round fibers, but more often than not cigarettes sold in the United States have fibers that have a specific shape to them, either a Y cross-section like in this lower part of the picture or an I-beam cross-section. And the function of -- of -- of using -- or the reason for using fibers that have this kind of shape is that it increases the surface area of the fiber per unit weight and -- and increases the filter efficiency. Of course there are unique fiber shapes -- I'm sorry, unique filter shapes to try to further increase filter efficiency and overall general reduction.
Up in the right-hand corner we see that fiber density is important, and if -- if one -- this

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probably makes sense superficially, because if one packs more fibers in the filter, then it's going to be a more efficient filter.

And then finally filter length. Obviously the longer the filter, the more efficient it is in removing the particulate phase.

Q. Doctor, let me move the other chart and ask you to draw how a filter works just as a matter of physics, if you would.

MR. WEBER: Your Honor, may I inquire, is the court able to see that?

THE COURT: Yes, I have no problem.

MR. WEBER: And can you inquire as to whether the jury can? Okay?

THE COURT: Is that okay?

(Affirmative response.)

MR. WEBER: Thank you, Your Honor.

BY MR. WEBER:

Q. Dr. Townsend, would you, using that chart and that paper, go ahead and explain how a cigarette filter works as a matter of physics with the particles.

A. Well this is a fairly complicated area, particle capture on fiber filters, but I think there are three major mechanisms that be be considered for cigarette filters, and what I'll -- what I'll do is just describe those three major mechanisms of how filter fibers trap particulates. And to do this, let me

draw a cross-section of a fiber, and just to keep it simple, we'll make this a round fiber. So we're looking at the cross-section of a round filter fiber. And if smoke is flowing around that -- through the filter and around the fiber, the smoke will follow stream lines generally around that single fiber, and what I'm indicating is the flow is moving generally in that direction around the fiber, so it diverts around. Now if a particle is traveling in the smoke stream and it's following one of these stream lines, if the momentum is sufficiently high either by virtue of a high velocity or a large particle mass, the particle can actually break away, can travel following the stream lines and can actually break away from the streamline and collide with the front edge of the fiber, and once that particle touches the fiber, the particle is liquid, it will stick, it doesn't generally bounce off. So we call this kind of capture mechanism impaction.

Q. While you're writing this, --

A. Yes.

Q. -- excuse me, I want to walk over here so I can see as well.

A. All right.

Q. Thank you.

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A. A second mechanism that we think is important in removal of smoke particulates is when a -- when a particle is following a stream line, it doesn't have sufficient momentum to break away from that stream line and hit the front edge as the first case, so it follows around the fiber, but as it does it's following a stream line that's so close to the edge of the fiber that as it goes around it touches and sticks. We call that kind of -- that removal mechanism interception. Now that follows the stream line, too.

And then the third major mechanism that we think is important is when the particle is actually following the stream line further removed from the fiber and so it doesn't touch, it doesn't have sufficient momentum to break away and collide with the front edge, and it's way out here from the surface of the fiber, but because this -- if this particle is small enough, it -- there's a finite probability that it can side step and touch the -- touch the fiber and stick. We call that diffusional deposition. And it's because -- and it works because small particles and molecules, of course, are -- are constantly moving in random motion, Brownian diffusion, so a particle can also side step or

actually break away from this stream line and -- and touch the surface of the particle and stick. That's diffusional deposition.

There are other mechanisms that could apply, but we think from the work that we've done that these are the three most important.

MR. WEBER: Your Honor, I've marked this chart as Exhibit 50004, and I'd move its introduction for demonstrative purposes. That is the chart that Dr. Townsend just prepared.

MR. CIRESI: No objection, Your Honor.

THE COURT: Court will receive 50004 for illustrative purposes.

MR. WEBER: Now -- I'm sorry, Your Honor, I almost interrupted you.

BY MR. WEBER:

Q. On this subject of filters and how they work, is it possible, Dr. Townsend, to make a filter that essentially is so efficient that it collects all the smoke?

A. It is possible to -- to develop a filter that will collect virtually all of the particulates.

THE COURT: Excuse me, counsel. I don't mean to interrupt, but I don't want the doctor standing on top of the jury. If you're going to use

the exhibit, then please, can you set it up against something?

MR. WEBER: Okay.

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THE COURT: Set it on the board.
MR. WEBER: Let met put it right here right now, Your Honor.
THE COURT: Then stand on the other side so the reporter is able to hear your testimony.
MR. WEBER: Yes, Your Honor.
THE COURT: Thank you.
A. It is possible to make a cigarette filter that will remove virtually all the particulates by using high fiber density, by using high-surface-area fibers, by using -- make the fiber long enough. So yes, it is possible to remove virtually all the particulate matter.
Q. And would --
Based on your experience at R. J. Reynolds, what would the effect of such a filter be in the marketplace?
MR. CIRESI: Well objection, Your Honor, unless there's been some testing of it.
THE COURT: Okay. Maybe you should lay some foundation for those statements.
BY MR. WEBER:

Q. Do you --
Based on your 20 years at R. J. Reynolds, do you have experience as to whether efficiency of a filter affects its marketplace performance?
A. Yes, I do.
Q. And would a filter that filtered out all the smoke be a design which you would consider at R. J. Reynolds?
A. No, it isn't.
Q. And why would that be?
A. Because for two reasons. If a filter removes virtually all the particulates from the smoke, there would be virtually no taste, there would be -- and that would not an acceptable-tasting product. The second --
MR. CIRESI: Excuse me, Your Honor, then I'm going to object, there's no foundation for this witness with regard to what imparts the taste. He's not qualified in that area.
THE COURT: I'll let the answer stand.
Q. Now the -- I'm sorry.
A. I'm sorry, there was a second piece to that. The -- the second reason I think those -- those kind of filters wouldn't be consumer acceptable is that the pressure drop or the -- how hard it is for the

consumer to draw through that filter would be so large that it would -- it would be very difficult to -- to draw on. The consumer would find that unacceptable as well.
Q. Now I want to move now, Dr. Townsend, to another general reduction technique you identified, and that is reconstituted tobacco.
A. Yes.

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Q. And I'd like to hand you what's been marked physical Exhibit 1, P1 --
A. Yes.
Q. -- and ask if you could identify that as a reconstituted -- a sheet of reconstituted tobacco?
A. This is a sheet of reconstituted tobacco.
MR. WEBER: Your Honor, I'd move the admission of physical Exhibit P1.
MR. CIRESI: No objection for illustrative purposes, Your Honor.
THE COURT: Court will receive P1 for illustrative purposes.
MR. WEBER: Your Honor, what we --
When I have Dr. Townsend explain this process, could I have the court's permission to have the bailiff just pass another sheet through the jury?
THE COURT: No. The clerk may though.

MR. WEBER: Okay.
(Clerk complies with request.)
MR. WEBER: Thank you.
BY MR. WEBER:
Q. Dr. Townsend, could you explain the process that's used to make reconstituted tobacco sheet.
A. Yes, I will. And let me start by saying that one of the main reasons for inventing this process -- and Reynolds invented this process originally back in the late '40s -- was to take pieces of tobacco that were too small to use in cigarette manufacture and make them into larger pieces that we could use efficiently and effectively in cigarette manufacture. Reconstituted tobacco -- let me back up from there.
When we receive or purchase tobacco leaf, of course it's like any leaf, it has a mid rib and then it has small stems that come out from the mid rib, and then in between the stems is the leafy portion of the tobacco leaf. One of the first things that we do when we receive tobacco in -- in what we call the stemmery is we remove that mid rib and we remove the stems, leaving sections of the leafy portion we call lamina. The -- in -- in doing this, in separating the stems and mid rib from the lamina, we generate a

lot of small tobacco pieces, pieces that are too small to -- to use in cigarette manufacture. And so R. J. Reynolds developed this process, as I said, in the late '40s, to try to recover that material and make it into larger pieces.
We do that by taking some stems and some of these small lamina pieces that are too small, and even in some cases tobacco dust that results from this stemming operation, and -- and -- and make a paper sheet. And that's exactly what this is, is a paper sheet.
Now the way paper sheets are made, one takes fibers and generally suspends them in a -- in a water

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solution so that you have a lot of fibers and a lot of water, and then that entire suspension is laid down on a wire screen. The water falls through the screen. All the fibers, of course, are stopped -- are stopped by the screen in a random placement, and you form a paper sheet. So that's what Reynolds wanted to do in developing this paper sheet of reconstituted tobacco. But to do that, because there's so much water involved in the process, Reynolds found very quickly that it needed to extract water solubles from the tobacco materials before the paper sheet is made.

So currently the way we do this process is we take the -- some stems, the small pieces of the lamina, and in some cases small amount of tobacco dust, and we'll place it in a large kettle, add water, and extract out everything that will come out in that water. We hold that water with the water solubles to the side. We take what's left, the fibers, the stems and the fibrous portion of the tobacco, and we make a paper sheet just like the one we see here. And then after the paper sheet is made on this wire screen, we take the water solubles that we held out to the side and then we spray back on here, because it contains a lot of flavorful compounds, nicotine and a number of other things. So we hold that extract to the side and then reapply.

Then once we have a sheet like this, it's cut into smaller sections and then fed through our what we call primary processing where it's then blended with other tobaccos like flue-cured burley and Turkish tobaccos.

Q. Is that a fresh sheet of reconstituted tobacco or --

A. This is pretty old.

Q. Thank you.

If you'd resume your seat now.

A. Okay.

Q. Now how does reconstituted tobacco sheet compare with normal leaf with respect to tar and nicotine?

A. Well we found, and I think the original -- the original invention was, as I said, to use small pieces that we couldn't otherwise use in manufacture, make it into larger pieces that we could use -- what we found after the fact was that reconstituted tobacco actually generates less tar because the -- primarily because the stems that are used in the process, when pyrolyzed, don't generate as much tar as regular lamina. Also, the stems that are used have a very low nicotine level, and so that serves to reduce nicotine level as well as tar. Also stems in the reconstituted sheet will increase the burn rate of the tobacco rod a bit, so there is a slightly shorter puff count that also reduces tar level. So two main reasons.

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Q. Generally, what percentage of commercial cigarette blends in which different tobaccos are used, what percentage of the blend in general consists of reconstituted tobacco sheet?
A. Typically the range is around -- you know, between 15 and 25 percent. In a few brands it can get up as high as 30 percent, a few brands maybe as

low as 10 percent.
Q. Why isn't more reconstituted tobacco sheet used in a blend?
A. Because if one goes to a much higher -- or significantly higher level than, say, 25 or 30 percent, you start seeing off-taste problems, you see a very different taste; consumers find that unacceptable.
Q. When the tobacco extract that you referred to, the water solubles that are removed as part of this process, when that's sprayed back on to the sheet in the paper-making process, is any additional nicotine from any other source added?
A. No.
Q. Now has R. J. Reynolds from time to time used ammonia or ammonia compounds in its reconstituted tobacco process?
A. We have, some.
Q. As of 1994 what percentage of brands and styles had some ammonia reconstituted -- ammonia processed reconstituted sheet in the blend?
MR. CIRESI: Your Honor, may I just ask what time in 1994?
MR. WEBER: Prior to the filing of this lawsuit in -- let's say any time the first six months

of 1994.
A. The level in 1994 was about 39 percent of the products we sold had ammoniated reconstituted tobacco.
Q. When did Reynolds first use any ammonia in its processing of reconstituted tobacco sheet?
A. The first commercial use of ammoniated reconstituted tobacco was in 1974 in Camel Filter.
Q. And when was the next time that Reynolds used ammonia in its processing of reconstituted tobacco sheet for a commercial product?
A. We implemented ammoniated reconstituted tobacco in Winston Filter in 1979.
Q. So from '74 to '79, the only brand that had any ammoniated reconstituted sheet was Camel Filter?
A. I believe that's correct.
Q. Now was the use of the reconstituted tobacco technique made known to the scientific community and the public?
A. Yes, it was, in -- in a number of ways. There was a presentation by our CEO at the time before Congress. Back in the '50s Wynder and Hoffmann published an entire chapter in their book on

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reconstituted tobacco. It was spoken to in the Banbury report that we talked about this morning. It

was spoken to in the National Cancer Institute program toward less hazardous cigarettes, which directed the work of the Tobacco Working Group; reconstituted sheet or reconstituted tobacco was an important part of that study. I think there were a number of -- a number of references in -- in the literature.

Q. Has the use of reconstituted tobacco sheet been evaluated in Surgeon General's reports as well?

A. Yes, it has. Also, there are a lot of patents in the -- in the literature, in the open patent literature on reconstituted tobacco.

Q. When you said a moment ago that reconstituted tobacco was discussed in the Wynder and Hoffmann book, is that 1967 "TOBACCO AND TOBACCO SMOKE," which is already in evidence?

A. That's the book I was referring to.

Q. Now let's move, if we could, Dr. Townsend, to touch on those general reduction techniques that use the concept of using less tobacco.

A. Okay.

Q. And I think you mentioned several have touched on that. The reduced circumference?

A. Right. Well if we -- if we start in the bottom right-hand corner, reduced circumference, again, will

reduce the amount of tobacco that's burned when the cigarette is burned. Shorter tobacco rods will also, of course, reduce the amount of tobacco burned, generating less tar. And a third way for reducing the amount of tobacco rod weight is to make changes to the cigarette maker, to actually pack less tobacco into the rod, make it as loose as you can and still keep a consumer-acceptable tobacco rod. Then the major technique for further reducing tobacco weight in a burning cigarette is the next one up, the use of expanded tobacco.

Q. Now who invented the process for expanded tobacco?

A. R. J. Reynolds developed -- invented and developed the very first process for expanded tobacco. I think the original invention was in the mid-'60s, and we first commercialized it roughly in 1970, I believe.

MR. WEBER: Your Honor, may I approach the witness with an exhibit?

(Two glass jars handed to the witness.)

BY MR. WEBER:

Q. Dr. Townsend, I've just handed you what's been marked physical Exhibit P10 and physical Exhibit P10A. Can you identify what those are?

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A. Yes, I can. One jar contains non-expanded tobacco --
Q. And which is the number on the non-expanded?
A. That's Exhibit P10 contains non-expanded tobacco. Exhibit P10A contains an equal weight of expanded tobacco. So the tobacco in the two jars is the same weight. The expanded tobacco, obviously, fills a larger volume.
MR. WEBER: May I move those into evidence, P10 and P10A, physical exhibits, Your Honor, for demonstrative purposes.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive P10 and P10A for illustrative purposes.
BY MR. WEBER:
Q. And if you could just hold those up again for a moment, Dr. Townsend, with the labels toward the back so -- toward you so the jury could see. That's the same amount of tobacco in each jar?
A. The same weight of tobacco in each jar. The expanded jar that I'm holding up higher obviously occupies a larger volume even though it's the same weight as the unexpanded.
Q. Now how is it that the same weight of tobacco can, through processing, occupy a larger volume?

A. Well that's where the name came from. We've expanded the tobacco. We did that in --
Actually the process is not terribly different than popping popcorn. One heats the tobacco and -- well let me -- let me back up. One impregnates the tobacco with a solvent, and the solvent will actually go into the cells, into the cell structure under pressure, and then when the pressure is released and the sample is heated very quickly, the solvent evaporates very quickly, disrupts the cell structure and actually swells or puffs the -- the building -- the backbone of the tobacco, so it -- it actually pops or puffs the tobacco. We also call this puffed tobacco or expanded tobacco.
Q. How does expanded tobacco contribute to a general reduction of tar and nicotine yield?
A. Well I think it's clear that this expanded tobacco occupies a larger volume for an equal weight, so we can reduce the weight of the tobacco in the -- in the cigarette and still fill the rod and have a nice, firm rod, one that's -- that -- where tobacco pieces aren't falling out the end.
Q. Is there a limit to the amount of expanded tobacco that can be used in a cigarette?
A. Well technically there's not a limit. One can

make a hundred percent -- or a cigarette of a hundred percent of this. From a practical standpoint there's a consumer acceptance limit, and it seems like the maximum practical limit is somewhere around 50 or 55

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percent expanded tobacco.
Q. Does Reynolds and other companies incorporate expanded tobacco or puffed tobacco in their commercial products?
A. Reynolds uses expanded tobacco commercially, and all of our domestic competitors use expanded tobacco as well.
Q. And is expanded tobacco as part of the blend mixed in with other tobaccos?
A. Yes. What we do is take the expanded tobacco and then we'll mix it with flue-cured burley and Turkish laminae, which has a low density -- I mean -- yeah, a low density, and then also add reconstituted sheet as well. So it's a blend that contains this.
Q. Let's focus on the Reynolds process for just a moment. What --
Did Reynolds use a chemical agent as part of its initial process to expand the tobacco?
A. Yes. The chemical agent we used in our first invention or our -- the process we invented in the mid-'60s was freon, or F11.

Q. Did Reynolds evaluate -- strike that.
Prior to incorporating expanded tobacco in this process into its commercial cigarettes, did Reynolds test the smoke of the cigarettes made with expanded tobacco?
A. Reynolds did extensive chemical and biological testing of the smoke from cigarettes made with the freon expanded tobacco.
Q. And did it disclose that research regarding expanded tobacco to other companies to whom it was trying to sell the process?
A. It did. We first commercialized this -- this process and we began using it, then we wanted to license it to some other tobacco companies around the world. We disclosed the detailed chemistry and the biological testing that we did to the companies that were interested in possibly licensing this. As a result of this, those companies, in some cases our scientists as well, provided some of the information to non-industry people; for example, the Hunter Committee in the U.K. There were some individuals from the German Health Ministry and also some government officials from Japan that received chemical information and the biology.
Q. Now you mentioned the Hunter Committee. Is that

the --
Was that the informal name at the time for what was known as the United Kingdom's Independent Committee on Smoking and Health?
A. That was at one time the informal name for the Independent Scientific Committee on Smoking and Health, and that committee was under -- under the auspices of the British Health Minister.
Q. And did that committee at the time have the duty

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to approve or not approve additives or processes that used ingredients with respect to commercial cigarettes?

MR. CIRESI: Objection, Your Honor, it's outside the scope of discovery, and it's irrelevant to this action.

THE COURT: Sustained.

BY MR. WEBER:

Q. Was the use of Reynolds expanded tobacco approved by the Hunter Committee in Britain?

MR. CIRESI: Same objection, Your Honor.

THE COURT: Sustained.

MR. WEBER: Could I approach the side-bar for a minute on that, Your Honor?

THE COURT: All right.

(Side-bar discussion as follows:)

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(Side-bar discussion concluded.)
THE COURT: Where is the sheet of tobacco? We're just trying to maintain control of exhibits.
MR. WEBER: For the clerk, Your Honor?
THE COURT: Please.
THE CLERK: The jars as well.
MR. WEBER: The jars are up there.
THE COURT: They should be with the clerk.
(Physical exhibits handed to the clerk.)
THE COURT: Go ahead.
MR. WEBER: Thank you, Your Honor.
BY MR. WEBER:
Q. Dr. Townsend, does R. J. Reynolds still use the same process for expanding tobacco it initially used?
A. No, it doesn't.

Q. Does it still use freon as an expansion agent?
A. No, it doesn't. And that's --
Q. And when --
A. That's why we don't use the first process.
Q. When did R. J. Reynolds change that process, if you recall?
A. Approximately 1988, as I -- as I recall.
Q. And what was the reason for changing that process?
A. Well, of course, freon has been implicated as an environmental -- as -- as influencing the ozone layer, the ozone hole that we've all heard about, so for environmental reasons we quit using freon.
Q. Now based on the chemical work that was done with respect to the expanded tobacco when it was tested before it was put into commercial products, --
A. Right.
Q. -- what did R. J. Reynolds learn about whether freon used as an expansion agent would transfer to

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smoke?
MR. CIRESI: Your Honor, may we have some foundation with regard to what was done?
THE COURT: Well you can answer the question.
A. What we found from extensive chemical

evaluations of smoke with freon-treated tobacco was that we didn't see -- there -- there were trace levels, like probably no more than five parts per million freon in tobacco, and in mainstream smoke we didn't see freon.
Q. Now let's turn, if we could, to air dilution, and I think there are several air-dilution methods referenced on the chart that's displayed.
A. There are two actually.
Q. All right. Which one would --
Well let's start with the dilution methods. And what I'd do now is ask you to turn to tab 29, which is X2543. Is that a chart you prepared to help you focus on the air-dilution methods?
A. Yes.
MR. WEBER: Your Honor, I'd move X2543 for demonstrative purposes.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive X2543 for illustrative purposes.
BY MR. WEBER:
Q. Dr. Townsend, could you explain how -- what air dilution is, how it works, and how it contributes to general reduction?
A. Yes. Let -- let me start and direct your

attention to the upper portion of this exhibit, filter ventilation. Filter ventilation, or we call it sometimes air dilution, is -- is a means for tar and nicotine reduction, and the way that occurs is that one perforates the filter and -- with -- and places small holes in the filter so that when a smoker draws on the cigarette, a portion of what goes in their mouth is -- is air from the outside. So it dilutes the smoke. The other consequence of doing that is if a portion of the smoke that goes in a smoker's mouth is that diluting air, then there's less air being drawn through the front end of the cigarette where the combustion and pyrolysis take place, so there's less smoke actually generated.
Another consequence of that is once the smoke is generated, the reduced amount of smoke generation, the velocity of the smoke down the tobacco rod and into that front edge of the filter before you get to the -- to the vents in the -- at the middle of the tipping paper, the smoke is moving slower, and so it's removed more efficiently by the tobacco rod and especially by the filter that's upstream of those air-dilution vents. So you see, placing those perforations in the cigarette has multiple effects.

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There's some interactive effects going on. And using air dilution will increase the filter efficiency substantially. So it not only dilutes it, it generates less smoke, but it also works interactively to increase the filter efficiency. That's for filter ventilation.

If you'll direct your attention to the lower half of the exhibit where I've indicated paper porosity, cigarette paper can actually be constructed so that it has a large number of pores or holes in the paper. Those holes can be either inherent, they can be just normal porosity through the fiber bed, or they can be electrostatically perforated. So you can actually place holes after the -- after the paper is manufactured. In any event, paper -- increased paper porosity will allow air to come in through the paper when a smoker is taking a puff on a cigarette, so again a portion of what goes in -- into the smoker's mouth is air from the outside. It also will reduce the amount of smoke generated and the pyrolysis of -- of tobacco because there's less air being drawn through that part of the cigarette. And -- and I -- I will say that paper porosity is not as effective in reducing overall tar and nicotine as filter ventilation, but they're both important tools.

Q. You mentioned the possible effect on filter

choice and filter efficiency by using air dilution. Does air dilution allow more options to the designer in terms of filter efficiency?

A. Oh, it -- it allows a lot of additional options, because -- and again, the cigarette is so interactive, if one changes one design element of the cigarette, it ultimately affects the cigarette performance in -- in a number of ways. The example I just used with filter ventilation affecting the filter efficiency level is very important, and the cigarette designer then can trade these design characteristics. For example, one can build cigarettes with a low -- slightly lower filter ventilation level and a higher filter efficiency, or one can build a cigarette with the opposite, with a high ventilation level and a lower filter efficiency, and -- and achieve essentially equivalent tar levels. So it gives the cigarette designer some flexibility, certainly.

Q. Now Dr. Townsend, did the Surgeon General in 1979 evaluate the effects of a number of these general reduction design techniques?

A. Yes, he did.

MR. WEBER: Your Honor, because of the detail on this chart, we had to blow it up a little

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bit larger than normal, but this is a copy of page 14-114 of the 1979 Surgeon General's report, which is in evidence actually under two numbers, PX3836 or MD000113, and what I'd ask is if I could have the court's permission to have Dr. Townsend come down and speak about some of the markings on this chart, Your Honor.

A. I'll stand right here.

Q. Position yourself there.

MR. WEBER: Is he fine there, Your Honor?

THE COURT: It's fine, yes.

MR. WEBER: Okay. And hand you a pen to point it out.

Q. If you could explain the significance of that chart with respect to design techniques that we've been speaking about.

A. Okay. First, this is a chart taken from the U.S. Surgeon General's report, 1979, and what we're looking at is a number of cigarette design techniques or characteristics. Some of these we've talked about.

Over here in the -- in the main body of the table are a bunch of pluses and minuses, and let me make it clear what we're talking about. If -- if an entry has two pluses, that's defined as more than a

50 percent reduction; if it has one plus, that's defined as a significant reduction, less than 50 percent, but still significant; if it's a plus minus, one on top of the other, then it's an insignificant change; if it's plus minus and a question, then it's a questionable change, I'm not really sure; if it's a minus, it's an increase; and if it's a question, it's unknown.

So what the Surgeon General did in this -- in this table is compare these design characteristics and talk about its effectiveness in CO reduction, carbon monoxide, ciliatoxicity -- and you remember the ciliastasis theory -- tar, tar reduction, nicotine reduction, BaP, also benzpyrene, carcinogenicity, measured by mouse skin-painting, and then the level of tumor promoters, and then on the far right are some remarks for a few of those entries.

Let's point, first, to porosity of paper for example, and the Surgeon General notes that the use of high porosity papers results in a significant, more-than-a-50-percent reduction in the CO, a significant ciliatoxicity reduction, reduction in tar, reduction in nicotine, reduction in benzpyrene, and questionable on carcinogenicity.

If one looks at perforated filters, what we've just been talking about in the last few minutes, perforated filters, double plus for carbon monoxide reduction, reduction in ciliatoxicity, reduction in tar and nicotine, carbon monoxide, and you see all

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the way down.
The use of cellulose acetate filters without air dilution, again a bunch of pluses across.
To be fair, the plus minus is out here on carcinogenicity.
The use of a charcoal filter, now you see a double plus under ciliatoxicity. Back to the ciliastasis theory.
The use of expanded tobacco, again -- well here we see double pluses for tar and nicotine and benzpyrene, so expanded tobacco had a major effect on the reduction of tar and nicotine and benzpyrene.
The use of reconstituted tobacco sheet, and this entry is the one that we've employed at Reynolds, the -- the paper process, and you'll see pluses across. There's also a different kind of reconstituted sheet, there are different types of processes that our competitors use, and that one also had pluses.
We can also look up here in the effectiveness of

the extraction. Remember, we tried to selectively reduce benzpyrene through extracting the precursors to the formation of benzpyrene, and the Surgeon General indicated that, yes, it does happen, it -- as I've already said, there was a technical reduction in BaP, there was a reduction in tar and nicotine as well, but the Surgeon General concluded it's of academic interest only.
If we also look down to additives to the tobacco, and in this case nitrate additives which we've already discussed, again here you'll see some pluses. Here's an increase in ciliatoxicity, though. See there, there's a minus there. But there is a reduction in tar, nicotine, BaP, reduction in carcinogenicity, but the Surgeon General concluded that that's only of academic interest, too, because a number of scientists were really questioning the wisdom of adding nitrate to cigarettes.
Q. Dr. Townsend, is there also a footnote down at the bottom that relates to the charcoal filter?
A. Yes. The second footnote here says -- bifocals work right -- "Reduction of tar, nicotine, and BaP are, in general -- are, in general, greater with cellulose acetate filters than with charcoal filters."

MR. WEBER: Your Honor, give me just a moment, I'll remove this and then I'll put up another one.
Q. Was this, by the way, this chart you were just talking about, a chart made by one of the tobacco companies?
A. This chart? This is from the Surgeon General's report.
Q. Dr. Townsend, let me now show you a chart from an article that's admitted is 26003, PX26003. It may

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also have been admitted under BYP000260.
MR. CIRESI: Excuse me, let me get it, please. BYP000 --
MR. WEBER: 000260.
MR. CIRESI: -- 260? Thank you.
MR. CIRESI: Okay.
BY MR. WEBER:
Q. On the first page I've got a --
This is a copy of a chart from Dr. Samet's article, and that -- and that deals with a sales-weighted tar and nicotine measurement.
A. Yes.
Q. Could you explain that chart for the ladies and gentlemen of the jury, Dr. Townsend.
A. Yes. And this is from the Department of Health

and Human Services, 1989, and that's Dr. Samet's graph. What Dr. Samet shows here is what's called sales-weighted tar level as a function of time beginning in 1955 and continuing to 1989, thereabouts. What Dr. Samet shows is that the tar level of the -- the sales-weighted average tar level, and what that is is the level of tar at which half the cigarettes sold in the country are higher and half the cigarettes sold in the country are lower, so it's the sales-weighted average, and in -- well, actually his graph starts roughly 1996, and he's showing in the mid to -- oh, roughly 35, 36 milligrams of tar per cigarette, and showing that decline over time to 1989 to about -- this -- this chart shows roughly maybe 14, 15 milligrams, if I can estimate off from here correctly.
Q. Dr. Townsend, let me interrupt you. I think you said the graph starts in 1996.
A. I'm sorry, 1956.
The dash line is the sales-weighted nicotine level in the U.S. market, and in 1956 the nicotine level, if I can eyeball it across there, is about 2.6 milligrams per cigarette, and then the nicotine level declines to about, oh, say little over .9 in 1989.
These data are actually consistent with data

that we've -- we've generated internally to R. J. Reynolds.
The other thing that Dr. Samet shows here is the introduction of some of the main design tools that we've -- that the industry has developed for general tar and general nicotine reduction.
Q. What's the significance of the data on this chart to you as a cigarette designer, Dr. Townsend?
A. The main significance is that the design tools that have been developed and in place in the market have made a major reduction in the tar and nicotine level in the U.S. market over time.
Q. Could you sit down now and we'll proceed?
MR. CIRESI: I think the record should reflect that I think the chart starts in '55, not

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'56.
MR. WEBER: '55.
THE WITNESS: But the first data point is '56.
MR. CIRESI: Okay.
MR. WEBER: I'm going to have to get better at this, Your Honor. I'll just take a second.
(Easel moved.)
MR. WEBER: I'm going to leave this up for a moment. Is that okay?

BY MR. WEBER:
Q. Dr. Townsend, in the course of this general reduction we've been speaking about, have specific constituents been reduced as part of this?
A. Yes. Through general reduction, of course, by reducing tar and nicotine both, and reducing tar, one reduces all the constituents of smoke more or less to the same degree, so certainly the -- the mainstream constituents in smoke are reduced pretty much as -- as you see there on -- on the chart.
Q. Could you turn to tab 31, which is X0523.
A. Yes.
Q. And is that a chart that represents the reduction in benzpyrene in a Winston over a period of years?
A. Yes.
MR. WEBER: Your Honor, I'd move the admission of X0523 for demonstrative purposes.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive X0523 for illustrative purposes.
BY MR. WEBER:
Q. Could you discuss the significance of this chart, Dr. Townsend.
A. Yes, I will.

As a result of general reduction of tar, what we've seen is also a major reduction in various smoke constituents. This exhibit shows you the effect on benzpyrene over the years. It's starting -- actually it's a two-year comparison. Starting in 1956 we measured about 52 nanograms of benzpyrene per cigarette, 52 billionths of a gram; in 1992 we measured, for Winston King Size cigarette, about 10 nanograms. So you see there's been a major reduction in the benzpyrene that's pretty much more or less paralleled the tar reduction.
Q. Now Dr. Townsend, could you turn to tab 32, that is X1261, and let me ask whether that's a chart that relates to tar levels -- (clearing throat) excuse me -- of R. J. Reynolds as compared to the industry sales-weighted average?
A. Yes, it is.
Q. Would that help you in your testimony in describing these techniques?
A. Yes.

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MR. WEBER: Your Honor, we'd move the admission of X1261 for demonstrative purposes.
MR. CIRESI: Your Honor, may I have some foundation as to who prepared this and where it came from?

BY MR. WEBER:
Q. Dr. Townsend, how was this chart prepared?
A. Staff under my direction collected the data from internal R. J. Reynolds data.
MR. WEBER: I'd move X1261 for demonstrative purposes.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive X1261 for illustrative purposes.
BY MR. WEBER:
Q. Now Dr. Townsend, let's start with the orange line in the middle. Is that an industry sales-weighted number?
A. The orange curve in the middle of the chart in fact is an industry sales-weighted tar level, actually very similar to what we've seen on Samet's chart. Slightly different scaling, because we, you know -- but it goes over a similar time period and shows the dramatic reduction in tar level on a sales-weighted basis.
Q. Now what does the -- I'm a little color bind, looks like a purplish line on top, could you describe that for us.
A. Yes. Well I'll -- I'll describe both of them. But the purple curve on the top is the highest tar

products that Reynolds marketed, manufactured and sold in any given year, as a function of time actually. The yellow curve on the bottom is the tar level, the lowest tar level product that R. J. Reynolds manufactured and sold in a given year. And if you look at this chart, you see -- I think there's two major important conclusions. First is that way back in the '50s, in the mid-'50s, there was a range of products offered to the consumer by my company, but the range is -- is -- looks like it ranges from about 38 to 50 milligrams per cigarette, so maybe a 12-milligram range. If you move out to 1986 you'll notice that the range is much bigger. R. J. Reynolds offers a much larger range of products to -- to smokers than it used to.
The other thing is that the -- that the high and low products offered by -- by Reynolds have come down, pretty much paralleling the sales-weighted average, and the highest tar products sold by Reynolds today is substantially lower than the lowest tar products sold by Reynolds back in the '50s. So not only has the tar level come down, but the maximum, the highest tar level product is lower than the lowest tar product we used to sell. And the range is bigger. And you'll notice that the range in

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tar level, if you look at the yellow curve, goes down almost to zero, and in fact there are products that Reynolds sells and our competitors sell as well that have levels of tar and nicotine so low that it's very difficult to measure those levels.

MR. WEBER: Your Honor, I don't know what the court's intention is as to a break. I can obviously adjust any way.

THE COURT: Are you going to a different area, or --

MR. WEBER: Well I'm -- I could -- I've got some more follow-up in this area, but I could break now or I could continue, whatever the court's preference is.

THE COURT: All right. Why don't you approach the bench now, counsel.

(Side-bar discussion as follows:)

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(Side-bar discussion concluded.)

THE COURT: Ladies and gentlemen, we'll recess for lunch and reconvene at quarter to 2:00.
THE CLERK: Court stands in recess, to reconvene at 1:45.
(Recess taken.)

AFTERNOON SESSION.
THE CLERK: All rise. Court is again in session.
(Jury enters the courtroom.)
THE CLERK: Please be seated.
THE COURT: Counsel.

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MR. WEBER: Thank you, Your Honor. Good afternoon, Dr. Townsend.
THE WITNESS: Good afternoon.
MR. WEBER: Good afternoon, ladies and gentlemen.
(Collective "Good afternoon.")
BY MR. WEBER:
Q. Dr. Townsend, having in mind the efforts of R. J. Reynolds in the general reduction area that we were discussing before lunch, I'd like to address now what the external scientific community was suggesting regarding cigarette design and general reduction, and I'd like to start by asking you to turn to tab 33, which is Exhibit GJ000043.
A. Okay.
Q. Make sure I can get it. Okay.
Now, is that a 1972 article that appeared in the Journal of the National Cancer Institute entitled "Sugar Content of the Tobacco and pH of the Smoke in

Relation to Lung Cancer Risks of Cigarette Smoking?"
A. Yes, it is.
Q. And if you look at the first footnote there, is this a document that was presented at a workshop of the Second World Conference on Smoking and Health in London?
A. Yes, it is.
Q. And is this a document on which you rely with respect to matters of smoke chemistry and cigarette design?
A. Yes.
MR. WEBER: Your Honor, I'd move the admission of GJ000043 under 803(18).
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive GJ000043.
BY MR. WEBER:
Q. Now this is a document from a publication from the Journal of the National Cancer Institute, 1972, and I want to ask you whether attached to the article, the last page, are a series of recommendations that members of the workshop made to the Second World Conference on Smoking and Health?
A. The last page, and that's page 1891, is a list of recommendations from that workshop.
Q. Now I'd like to start out with --

And does this include recommendations to smokers, to manufacturers, and to governments?
A. It includes recommendations to all three.
Q. Let's go to paragraph one which relates to recommendations to smokers. Do you see that?
A. Yes.
Q. And the first one is -- it says "The smoker who at present cannot quit should practice the following," then it goes on to say don't inhale. Do you see that?
A. Yes.

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Q. Then it recommends to the smoker fewer puffs, not to smoke all the way down, and then what's the next recommendation that was made to the World Conference on Smoking and Health to -- recommendations to the smoker?
A. It says to use low tar and low nicotine cigarettes.
Q. Now could you move down to recommendation number two. And those are recommendations -- these are recommendations, again, made to the Second World Conference on Smoking and Health?
A. Yes.
Q. Paragraph two are recommendations made to manufacturers; correct?

A. That's correct.
Q. Could you read paragraph two.
A. Yes. "Recognizing the difficulty of changing human smoking behavior, the Workshop stresses the need to modify tobacco products. The manufacturer should be encouraged to produce cigarettes with increasingly low -- lower tar and nicotine yields. This could be accomplished without legislation by self-policing and cooperation between the tobacco industries in various countries."
Q. And does that recommendation urge cooperation in this effort among tobacco companies?
A. Yes.
Q. I'd like you to go down to the third recommendation where it talks about recommendations to governments. Do you see that?
A. Yes.
Q. Could you read a), the first recommendation to governments there.
A. Yes. It says the "Government agencies should be responsible for:
"The regular publication of tar and nicotine levels -- determined by international standardized techniques -- of all smoking products for dissemination to the public."

Q. And is the FTC method a standardized test?
A. Yes.
Q. Now let's move later in the '70s. You should have a chapter 14 of the 1979 Surgeon General's report up there, both you and the court, in a separate copyset. That is previously admitted as PX3836.
A. I'm sorry, which one?
Q. Chapter 14.
A. Oh, I see.
Q. And could you turn to page 14-108 in chapter 14 of the 1979 Surgeon General's report.
A. 14-108. 108, okay.
Q. And what I'd like you to focus on is that top paragraph under "Tar." Would you read that first paragraph, please, --

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A. Yes.
Q. -- from the 1979 Surgeon General's report.
A. Yes. "In the experimental setting, a dose response has been established between tar application or smoke inhaled and tumor yield (reference 2 and 8). These data support epidemiological findings relating the amount of cigarette smoke inhaled and the likelihood of cancer of the oral cavity, cancer of the lung, cardiovascular disease, and respiratory

disease in humans (references 14, 41 and 45). Thus, as long as warnings of health hazards from smoking are disregarded and as long as cigarettes are consumed, efforts towards a reduction of tar and smoke constituents which may contribute to these health hazards should be continued."
Q. I think for the record you said "smoke constituents," but -- but I think does it not say "smoke components?"
A. At the end of the paragraph it says "efforts toward a reduction of tar and smoke components which may contribute."
Q. Now what's the significance to you of that last sentence you just read?
A. I think the significance is that as long as people continue to smoke, this modification of products to reduce the risk of smoking is a very useful thing and important thing to do.
Q. And that's the Surgeon General in 1979?
A. Yes.
Q. Let's go to 1983 now. If you turn to tab 36, that's G -- Exhibit GI000009, five zeroes with a nine, and let me ask you if you recognize that as one of the reports, scientific reports of the Independent Scientific Committee on Smoking and Health of Great

Britain?
A. Yes, it is.
Q. Are the reports of the Independent Committee -- Scientific Committee on Smoking and Health of Great Britain reports on which you and others in your profession reasonably rely on matters related to cigarette design and research?
A. Yes.
MR. WEBER: Your Honor, I'd move the admission under 803(18) of GI000009.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive GI000009.
BY MR. WEBER:
Q. And I think that if you'd turn to page eleven, recommendation -- well the paragraph 36, the first paragraph under "CONCLUSIONS." Could you read that.
A. Okay. Paragraph 36, "Cigarette manufacture has been undergoing a period of rapid change. We are encouraged by the decrease in tar yields over the last few years and recommend a continued reduction."
Q. If I could stop you there, doctor, what does

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that mean to you?
A. Well it -- they've seen a rapid reduction, an important reduction in tar yields. It means to me that they believe that that is a step in the right

direction, and encouraging the industry to continue that.
Q. Would you read the next sentence, please.
A. "We have recommended that nicotine levels should, in general, continue to fall but that there should be available to the public some brands with very low levels of tar and a proportionately higher nicotine yield though this should not exceed about 1 milligram."
Q. And what's the significance of that sentence to you, Dr. Townsend?
A. I think this sentence is consistent with a number of other things I've read in the public -- in the public health domain suggesting that a cigarette with possible risk reduction or a cigarette that might be safer is one with reduced levels of tar, but maintaining some level of nicotine to ensure consumer acceptance of those products.
Q. Now --
And again, just for the record, this is a report by an independent scientific committee to the government of Britain.
A. That's correct, the Froggatt Committee.
Q. Could you turn now to tab 37, AM005051. And the last exhibit we just looked at was the third report

of the Independent Committee -- Independent Scientific Committee. This is the fourth report; correct?
A. That's right.
Q. And this one's dated 1988?
A. That's right.
Q. Published under the authority of the British government?
A. Yes.
Q. And with --
Again, the reports of the Independent Scientific Committee on Smoking and Health are reports on which you and your field reasonably rely on matters relating to cigarette design and chemistry and matters of the like?
A. Yes.
MR. WEBER: Your Honor, I'd move the admission under 803(18) of AM005051.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive AM005051.
BY MR. WEBER:
Q. And if you could turn in the summary up front, I believe it's on page two, Dr. Townsend, and read recommendation number eight in "Product Modification."

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A. Yeah. This is under a section called "Product Modification."
Recommendation number eight says, "Government and the tobacco industry should consider what further action could be taken to persuade more smokers to favor low tar brands."
Q. And this was what year?
A. This is 1988.
Q. Now are these statements we've just gone through with the jury from the early '70s to the late '80s consistent with opinions that had been expressed by scientists outside the tobacco industry regarding what the companies should do with respect to cigarette design and engineering?
MR. CIRESI: Objection, there's no foundation beyond what he's testified to.
THE COURT: You'll have to lay foundation for that.
BY MR. WEBER:
Q. Do you know, first of all, whether or not the excerpts we just read from the Journal of the National Cancer Institute and the Surgeon General's report and two reports from Britain's Independent Scientific Committee, do you know whether or not those are consistent with recommendations of the

public health community throughout that period of time as to what should be done with respect to designing for lower tar and nicotine cigarettes?
A. I do.
Q. And can you -- is it --
Are these consistent or not consistent?
MR. CIRESI: Again, Your Honor, --
Q. With --
MR. CIRESI: -- there's no foundation.
THE COURT: Can you give us some citation or reference?
BY MR. WEBER:
Q. Are -- are --
Are you familiar with recommendations -- with the recommendations in the scientific literature regarding what should be done to cigarette products for those people who continue to choose to smoke?
A. I'm familiar with many, many references in the scientific literature about product modification to possibly reduce the risks of smoking. It spans many, many documents, both government documents, the Banbury reports and the Banbury conference, it spans scientific publications and a variety of peer-reviewed journals.
Q. And are the quotations we just read from the

early '70s, the late '70s and the late '80s consistent with recommendations that public health

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officials and outside scientists have made with respect to what should be done to cigarette design for those people who continue to choose to smoke?

MR. CIRESI: Your Honor, again I'm going to object. It's an overbroad question, beyond what he's -- the foundation he has testified to.

THE COURT: You may answer that.

A. Yes, I believe it to be consistent.

Q. Let me ask you a few questions now -- I'll put this down so I can see you up there. Let me ask you a few questions now, Dr. Townsend, about cigarette ingredients.

Have you become familiar in the regular course of your business at Reynolds with the procedure Reynolds uses to evaluate the ingredients it has in its cigarettes?

A. Yes.

Q. How did you become familiar with this process?

A. As a cigarette designer and product developer, I have had to, as a -- as a natural course of my job, to become familiar with how Reynolds evaluates various additives for their cigarette products. Part of the job.

Q. Does Reynolds evaluate the ingredients used in its cigarettes?

A. Yes, we do, and -- and we evaluate all of the additives in a number of different ways. First of all, we look at what's known in the literature about those additives and the safety of those additives. We evaluate the chemistry of breakdown products, we call that pyrolysis, of course, and we may actually evaluate pyrolysis studies that have been conducted and reported in the literature. We may go into our own laboratory and do those experiments ourselves. We also do extensive chemistry analysis and we also do biology, various biological end points. Take the bulk of the evidence, the bulk of the information, and make decisions about whether we use those additives or not and at what levels we should use those additives.

Q. What's your understanding of what -- the results of Reynolds' evaluation of its additives?

MR. CIRESI: Excuse me, Your Honor, we have no foundation as to which studies he's talking about, no documents for these studies. It's an overbroad question.

THE COURT: You may answer the question.

A. My understanding of the additives work that

we've done at Reynolds is that the additives we use in our cigarettes are not considered hazardous at the levels of use in those products.

Q. When did this process -- evaluation process go into place?

A. I would say generally in the early '80s, probably '83, '84, thereabouts, --

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Q. Um --
A. -- and in its current form.
Q. I'm sorry to interrupt you.
Did Reynolds and other domestic cigarette manufacturers retain a panel of outside experts to evaluate cigarette ingredients as well?
A. They did.
Q. Could you turn to tab 38.
A. Okay.
Q. Can you identify that as a report --
MR. WEBER: Well before I ask that question, Your Honor, I need to speak to you at side-bar about a minute, just on this exhibit before I proceed.
MR. CIRESI: May we have the exhibit number?
MR. WEBER: I'm sorry, Mr. Ciresi, it is AZ003322.

Your Honor. Thank you.

(Side-bar discussion as follows:)

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(Side-bar discussion concluded.)

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BY MR. WEBER:
Q. Dr. Townsend, are the ingredients used in cigarettes by the defendants in this case disclosed to the federal government as a matter of law?
A. Yes.
Q. When did that procedure begin, as best you remember?
A. I believe that procedure began in 1985 or 1986.
Q. And was the list of ingredients at some point thereafter publicly disclosed?
A. It was. It was publicly disclosed in 1994.
Q. Under the federal law on which you submit your list of ingredients to the federal government, is the Department of Health -- let me -- let me ask it differently.
Under that federal law, to what department do those ingredient lists go to?
A. The ingredient lists go to HHS, the Department of Health and Human Services.
Q. And under federal law is the Department of Health and Human Services, does it have any obligations once it receives that list?
A. Yes, it does. It has obligations --
MR. CIRESI: Excuse me, excuse me, doctor. Your Honor, it calls for a conclusion of law as to a

governmental agency on the part of this witness.
THE COURT: Okay.
BY MR. WEBER:
Q. Dr. Townsend, under the law, are you familiar with the law under which you have to report, you, R. J. Reynolds, have to report your ingredients to Congress?
A. I'm familiar with the responsibilities that we have under that law.
Q. Do you know whether or not HHS, the Department of Health and Human Services, has responsibility to report to Congress, just that one issue, report to Congress, if it finds any of the ingredients on that list may be hazardous?
MR. CIRESI: Excuse me, Your Honor, again I'm going to object as to what HHS does or doesn't do under the law. It's irrelevant. He's not qualified to testify as to that.
THE COURT: Can you just give us what the law is? Then we can --
I mean do you have that available?
MR. WEBER: I don't have the statute with me. I -- I could --
Can I ask whether he is familiar, what his understanding is at R. J. Reynolds with respect to

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the procedures of the federal government once that list is submitted?
THE COURT: Well I really don't want his understanding as to the responsibilities of the federal government. If you've got something that is specific under the law, he can relate what that is.
BY MR. WEBER:
Q. Let me ask you a different question, then, Dr. Townsend. In the years since the list of ingredients has been submitted to the Department of Health and Human Services, has that department ever come back to R. J. Reynolds and said that ingredients on that list are hazardous as used in cigarettes?
A. No, never.
MR. CIRESI: Excuse me, objection, Your Honor, it calls for hearsay on the part of the witness.
THE COURT: No, you may answer that. That answer will stand.
Q. Did R. J. Reynolds offer to supply its ingredients list to Congress at an earlier date?
A. It did, if it could be guaranteed protection for its proprietary -- or its trade secrets.
Q. Did R. J. Reynolds at one point publish a book on tobacco flavorings in 1972?

A. Yes, one scientist, Jack Leffingwell, published an extensive book that listed flavorings.
Q. Could you turn to tab 40, which is AU000024.
A. Yes.
Q. And can you identify that as a book entitled "TOBACCO FLAVORINGS FOR SMOKING PRODUCTS," and if you look on the inside cover, you'll see it's published by the R. J. Reynolds Tobacco Company in 1972?
A. That's correct.
Q. And who are the authors?
A. John C. Leffingwell -- we call him Jack -- Harvey Young and Ed Bernasek.
Q. And this is a document published by R. J. Reynolds?
A. That's correct.
MR. WEBER: Your Honor, I'd move the admission of AU000024.
MR. CIRESI: Under what? Under what rule?
MR. WEBER: Well we'd start with 803(16).
MR. CIRESI: It's not a learned medical treatise, Your Honor.
MR. WEBER: Right. 80316 is an ancient document, --
MR. CIRESI: Oh, well --
MR. WEBER: -- not a medical treatise.

MR. CIRESI: Sixteen you said?
MR. WEBER: Yes.
MR. CIRESI: I'm sorry, no objection, Your
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Honor.
THE COURT: Okay. Court will receive AU000024.
MR. CIRESI: This is the complete book, counsel?
MR. WEBER: Yeah.
MR. CIRESI: Okay.
BY MR. WEBER:
Q. And what's the total number of pages?
A. The last page is page 72.
Q. And could you just describe to the ladies and gentlemen of the jury what the nature of the book is?
A. Well it's a book that in the first few pages actually summarizes the use of ingredients and breaks it down into casing materials, which are largely or primarily sugars and glycerin, those, and then talks briefly about flavoring materials, and then has a very extensive list of compounds that are used as flavoring compounds in tobacco products, in cigarettes actually.
Q. Now we talked earlier about the expanded tobacco process. You remember that, Dr. Townsend?

A. Yes.
Q. And discussed the chemical testing there.
A. Yes.
Q. I wanted to follow up: Did R. J. Reynolds search for any one particular toxic by-product in connection with its examination of using freon?
A. It did. In the extensive chemistry and biology work that we did with the freon expansion process, we suspected at least chemically that it might be possible to produce a certain toxic chemical if freon were heated as a residual component of tobacco, so we searched extensively for the presence of that -- presence of that decomposition product.
Q. And did you find that?
A. No, we didn't. And in fact that was what I was referring to earlier in a question when I referred to there being no freon in smoke, there was none of the decomposition product in smoke that we found. There are trace levels of freon in the smoke, extremely low levels.
Q. Now let's turn to the topic of tobacco substitutes, and I'd like you to turn to tab 41, X2547. And is that a chart you prepared with respect to some of the tobacco-substitute work that R. J. Reynolds has done over the years?

A. Yes, it is.
MR. WEBER: Your Honor, I'd move X2547 for demonstrative purposes.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive X2547.
BY MR. WEBER:
Q. Now first of all, could you explain to the ladies and gentlemen of the jury, Dr. Townsend, what

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the whole concept of looking at tobacco substitutes was all about.
A. Looking at tobacco substitutes was an approach toward reducing tar and nicotine in cigarettes. It may include materials that are agricultural products, but not tobacco, in the hopes -- in the hopes of getting something that's simpler chemistry in the smoke; for example, something that may have a higher level of starch and may be less lignin or pectin or cellulose. It also included process materials like certain processed grains or even carbonized materials, again to simplify the smoke, to reduce tar, to reduce the chemistry of the smoke. That's the general approach.
Q. Could you discuss some of the information on the chart there.
A. Yes. And one thing I should have mentioned,

too, is the substitutes are intended to be possibly blended with tobacco, so it's to replace a portion of the tobacco with something that's chemically simpler, for something that chemically would generate -- or would generate a chemically simpler smoke.
What this exhibit tries to show is that we've evaluated at Reynolds a large number of prospective tobacco substitutes, and I've indicated an overall total of about 105. I think there's probably now a few more than that. And it's a mixture of ideas that we've generated inside the company versus some outside ideas that we've looked to, and some of those outside ideas are patented, some are ideas that we've just gotten from inventors or -- or even some suppliers to the industry as well.
The -- the -- the ideas that we've evaluated, actually, span a broad range from plants to carbonaceous materials to starches to expanded starches and a variety of things, and we've actually looked at a -- a lot of different things like, for example, kudzu, pretty well covering over the southeast, and we thought that might be a useful thing. It turned out it wasn't. But we've looked at a lot of possibilities.
Q. Have cigarettes containing tobacco substitute

materials ever been marketed here or abroad?
A. Yes, they have. Several small brands have been marketed in the U.S., particularly one made of lettuce leaves that I think many people have heard about. There's also one that's been marketed at least in a small area that's made of cocoa bean hulls. There was also larger marketing of products in England, France and Germany, and I believe to a degree in Switzerland as well, of products that incorporated tobacco substitutes. And some of those tobacco substitutes were from Celanese or Imperial Chemical, so there was cooperation between some members of the tobacco industry and those large

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chemical companies who were suppliers to develop those substitute materials.

MR. CIRESI: Excuse me. Your Honor, I thought he was just going to mention it briefly, but there's been no discovery on those items. It's outside the scope of discovery.

THE COURT: Let's move on.

BY MR. WEBER:

Q. Did Reynolds incorporate tobacco substitutes in any of its commercial products?

A. Not in commercial products. We've done a lot of experiments.

Q. Why haven't we incorporated -- Reynolds incorporated that into its commercial products, doctor?

A. We've found that the products we were able to make so far that show different chemistry are not consumer acceptable.

Q. Now in your 20 years in the R. J. Reynolds research department and based on your review of the records that we've seen, do you know whether cigarette design ideas were ever rejected because of Reynolds' position on whether or not smoking had been proven to be a cause of disease?

A. Absolutely not.

Q. Let me put up again that -- just for a moment -- this chart from PX26003, the tar and reduction nicotine chart, doctor. And there have been various versions of this that I think the jury has seen depending upon how it's calibrated, but I think in general is it fair to say tar and nicotine tend to move together?

A. Tar and nicotine do move together more or less. You know there's -- there's some differences in the spacing there, and that's primarily a result of the fact that filtration and air dilution and other general reduction techniques have slightly different

effects on nicotine than they do on tar. So, for example, a filter will remove tar slightly more efficiently than it will nicotine. Air dilution has a similar effect. But -- so the -- so the downward trend is pretty much parallel, but not exactly, because the tools affect the two differently.

Q. Do you know what the FTC policy is regarding whether or not Reynolds is required to report the tar and nicotine test results in its advertising?

A. I do know. We are required to report tar and nicotine numbers on all the products in advertising.

Q. And that's been since about when?

A. Since 1967, thereabouts, is when the test method was developed. I think the advertising was required by 1970, 1971, thereabouts.

Q. Has it always been the FTC's policy that Reynolds was required to publish the FTC test results in its advertising?

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A. Historically that's not been the position of FTC. And in fact, back in the '50s the FTC stopped tobacco companies, including Reynolds, from advertising tar and nicotine levels. After a period of time where the tobacco companies couldn't report or advertise tar and nicotine levels, then finally in the '60s, as I said, about '67, the FTC reversed its

position, developed -- established a standardized test method for tar and nicotine measurement, and then went on to require the publication in all advertising.

Q. Now let's talk about that FTC method for a few minutes, doctor. Could you just describe that briefly for the ladies and gentlemen of the jury?

A. You mean what the method is?

Q. Standardized FTC test method.

A. Yes.

The standard FTC method is -- is one that uses a smoking machine. The smoking machine is designed to take a two-second puff, so it's a two-second-long puff once a minute, and the volume of that puff is 35 cc's, or 35 milliliters. The prescription or the -- yeah, the FTC prescription goes on to specify many, many things, including the humidity of the room and the temperature of the room in which the cigarettes are smoked, because that affects the tar yields and nicotine yields to a degree. It specifies the preparation of the cigarettes. It specifies how long -- or I mean, sorry, how much of the tobacco rod you burn before the smoking machine stops taking puffs. It also specifies the collection system and it -- the specifications of the FTC method is --

requires that what we call a Cambridge filter pad, it's an extremely, extremely efficient glass fiber filter mat that's placed in a holder, the cigarette is inserted in that, that assembly is placed in the smoking machine, and all the particulates, all the droplets, are caught by this highly efficient Cambridge filter pad. Then that Cambridge filter pad is removed, the weight gain on the pad is -- is determined, and that weight gain is total particulates, and then to -- to arrive at a -- a tar number you have to know what the total particulate weight is and subtract the amount of nicotine and the amount of water from that. The difference, total particulate minus nicotine minus water, is by definition tar.

Q. Now are the tar and nicotine values reported by the FTC method an accurate predictor of what every individual will -- or what every cigarette will yield for every individual who smokes it?

A. No. The FTC test method, the FTC measurement of tar does not predict what any individual smoker will get. It never was intended to predict what any individual smoker would get. And the FTC said that

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in 1967 when they established the method. The FTC commissioner has repeated that since that time. The

FTC was never intended to represent what an individual gets.

Q. What is the value, as you understand it, to the FTC test method then?

A. I think there has been value for the FTC test method, and I think the FTC has seen that value as well, and that is it provides a comparative -- it provides comparative information for smokers, for consumers to make choices in the market, so that one can decide whether they want a lower tar, then they can -- they -- they have the necessary information to choose in a -- in a marketplace that includes more than 1600 different brand styles, it gives them the -- the numbers that allows them to make informed choices in the market.

Q. Now did the Britain's Independent Committee on Smoking and Health, do they use a similar method for measuring?

MR. CIRESI: Objection, irrelevant.

THE COURT: Sustained.

BY MR. WEBER:

Q. Would you turn to tab 37, document previously admitted, 005051.

A. Yes.

Q. And could you turn to page 53, please.

MR. CIRESI: Do you have the prefix, counsel?

MR. WEBER: I'm sorry. AM005051.

A. Okay, I'm on page 53.

Q. All right. And is this part of the report of Britain's Independent Committee on Smoking and Health?

A. Yes, it is. That's the 1988 report from the Froggatt Committee.

Q. Could you look down in that last paragraph on the first page of appendix three, and this deals with machine testing of cigarettes; doesn't it?

A. Yes, it does.

Q. Could --

Let me read a passage to you, and I'll ask you a question about it.

MR. CIRESI: Your Honor, it's still irrelevant with regard to the FTC method.

THE COURT: Sustained.

MR. WEBER: Your Honor, if I may, this document is in evidence as a learned treatise with respect to matters relating to cigarette design, and this relates to the cigarette design issue at issue here -- or matter at issue here.

THE COURT: Okay. I'm not sure I

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understand how it relates to the FTC's measurement of smoking.

MR. WEBER: Well there's just -- there's been a number of issues raised about these standardized tests, and there's a response here about standardized -- the value of standardized testing per se in this area. That's all I wanted to address.

THE COURT: Okay.

BY MR. WEBER:

Q. Dr. Townsend, let me read this to you beginning with "These parameters...," and they're referring to a standardized test method; correct?

A. Yes.

Q. It says, "These parameters have been criticized as not reflecting average human behavior and leading to published yields universally underestimating yields actually obtained by the average smoker. Critics of the machine smoking procedure have frequently failed to understand that values presented in tables published by DHSS have never been intended to be actual yields obtained by any one smoker. Rather, they enable brands to be ranked." And that's emphasis in the original. "This allows inter-brand comparison under a standard test procedure, presenting the smoker with information to enable him

to choose, if he so wishes, a lower yielding brand."

Is that consistent with the opinion you just expressed with respect to the value of standardized testing?

A. Yes, it is consistent.

THE COURT: Okay. Counsel, I would also note that my copy is not legible at all. If sometime you have an extra copy of that page, I'd appreciate receiving it.

MR. WEBER: Can I approach, Your Honor?

THE COURT: Sure.

MR. WEBER: I -- we noticed some copying problems. I thought we'd replace them. There was one with some coffee on, I believe.

(Document handed to the court.)

THE COURT: Thank you.

BY MR. WEBER:

Q. Dr. Townsend, there's been testimony in this case that one result of the fact that different people smoke differently is that some people may smoke lower yielding cigarettes in a way in which they change their smoking behavior, a theory called compensation. Are you familiar with that?

A. Yes.

Q. What do you understand "compensation" to mean?

A. I understand compensation to mean that smokers can change or smokers could change their puffing behavior or the number of cigarettes they smoke as a -- as a result of different physical or chemistry

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differences between cigarettes. For example, one may -- who normally smokes a high tar cigarette may be given a low tar cigarette and they actually puff that cigarette differently because the yields are different. One may also be given a cigarette that may have the same tar yield but have a different pressure drop or difficulty of drawing on it, and as a result may puff that cigarette differently, irrespective of any yield differences.

Q. Based on your 20 years' experience in designing cigarettes and studying cigarette design and your participation on the National Cancer Institute panel regarding the FTC method, do you have an opinion as to whether or not smokers compensate when smoking lower delivery cigarettes?

A. I do. I have a very strong opinion. I believe that cigarette smokers can and to a degree do compensate. I don't believe, based on the bulk of the data that's in the scientific literature and the work that we've done at Reynolds and elsewhere, and other scientists elsewhere, that smokers, however,

compensate fully. As a group, smokers of low tar and especially low -- ultra low tar products, as a group, get lower tar exposure. They don't get as low a tar exposure as you might predict from the FTC numbers, but it's still lower as a group. Also, I believe that individual smoking behavior is highly variable, not only from individual to individual but within each individual. One person will smoke a cigarette differently from puff to puff and from cigarette to cigarette. But as a group, I believe that compensation does occur for many smokers, I believe that compensation is not complete, and smokers of ULT products get less tar.

Q. Now can some smokers compensate by covering the air passages in the filter with their fingers or by taping it up?

A. I think that's -- that's certainly possible. Obviously, if one taped up the air-dilution vents that we talked about earlier today, there would be higher tar yield. If one stuck the filter further in their mouth and actually covered those vents with their lips, they would get a higher tar yield. And I think that can and does occur for some individuals who smoke. We've -- we've tried to estimate it at Reynolds, and -- and we know that -- that this vent

blocking does occur, but it's not a very frequent event.

Q. In your opinion, doctor, based on your 20 years at Reynolds, what is it that smokers may compensate for if compensation does occur?

MR. CIRESI: Objection, Your Honor, there's no foundation for this witness to testify to that.

THE COURT: Sustained.

BY MR. WEBER:

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Q. Have you done -- in the --
In the regular course of your business at R. J. Reynolds, doctor, have you evaluated the question of what smokers may be compensating for if they are in fact compensating?
A. I have.
Q. And what's your opinion as to that?
MR. CIRESI: I'm still going to object, Your Honor, there's still no foundation. What did he do? When? What kind of tests?
THE COURT: I think we'll need more foundation.
BY MR. WEBER:
Q. Could you describe some of the things you've done in the regular course of your business at Reynolds to acquaint yourself with the theories about

what individuals may be compensating for?
A. Yes. I've been involved in a number of experiments together with scientists who actually measure how people smoke, and -- and the way they do that is place a -- a probe on the mouth of the cigarette so that when a smoker draws on the cigarette you may actually measure flow profiles coming out of the cigarette and back-calculate what the total puffing behavior of that individual for each individual puff is, and then can go back and program a computer-controlled smoking machine to exactly replicate those -- that puffing behavior. As a product developer, working with those scientists, I've evaluated a number of different prototypes; for example, prototypes with similar tar levels but somewhat different nicotine levels. I've evaluated also -- we've evaluated also cigarettes with the same tar and nicotine levels in different pressure drops. So we've -- we've done a number of exploratory experiments of that nature.
Q. And based on that type of work and your 20 years at R. J. Reynolds, do you have an opinion as to what smokers may be compensating for if they are in fact compensating?
MR. CIRESI: Still have the same objection.

We don't have the documents with regard to any such experiments that the doctor is testifying to.
THE COURT: I think he can testify about the behaviors, but we haven't gotten to the next step, and that's why --

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You have to show his experiments have gone into that.

MR. WEBER: Let me see if I can come at it this way, if I might, Your Honor.

Q. Does tar --

Are there theories that tar may play a role in compensation?

A. There are theories that tar may play a role in compensation, yes.

Q. Can you explain that.

A. Lower tar cigarettes have less taste intensity, and the theory goes -- and it's quite simple -- is that if one who normally smokes a higher tar product tries to smoke a lower tar product, they'll find it has lower intensity, less flavorful, less taste, and may actually puff longer, harder or more frequent on that cigarette to get a stronger taste.

Q. Are there also theories that nicotine plays a role in compensation?

A. Certainly. There are theories that nicotine plays a role in compensation in exactly the same way. If a smoker who normally smokes a high tar and high nicotine cigarette tries to smoke a low tar/low nicotine cigarette, and if nicotine is very important to the overall taste and -- taste sensation, then the

theory goes that the smoker of the high tar cigarette may puff differently on the low tar/low nicotine cigarette to try to get more nicotine.

Q. Doctor, let me turn now to a different issue, and that is to what extent the government, federal government has been involved with Reynolds or other tobacco companies in evaluating different cigarette designs. And I want to focus you now on the National Cancer Institute in particular.

Was there a time when the companies and the National Cancer Institute worked in a joint project?

A. Yes.

Q. And was that a type --

Was that part of the National Cancer Institute's Smoking and Health Program?

A. Yes, it was.

Q. What time period was that?

A. The National Cancer Institute established the Tobacco Working Group in the mid-'60s. That work

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carried on -- it was a large experimental program which included government scientists, industry scientists, public health scientists, university scientists -- that work continued on in a -- in an intense way until about 1978, if I'm not mistaken. So I would say mid-'60s to '78 or thereabouts.

Q. Has the United States Department of Agriculture also worked with tobacco companies in various projects?
A. Oh, yes.
Q. Can you explain that.
A. U.S. Department of Agriculture, scientists that work at USDA frequently participate in the Tobacco Chemists Research Conference. They in a number of ways collaborate with various companies on agronomy and various aspects of tobacco production, beetle control, tobacco beetle control, a number of issues. So scientists at USDA have been directly involved.
There was a scientist from USDA involved in the -- in the National Cancer Institute's TWG program, Tobacco Working Group.
Q. As part of your responsibilities in cigarette design at Reynolds, did you read the reports of the National Cancer Institute Tobacco Working Group that were issued?
A. Yes, I have.
Q. And did the work of the National Cancer Institute -- strike that.
Was the work of the National Cancer Institute Tobacco Working Group of relevance to you as a cigarette designer?

A. It was directly relevant.
Q. Can you explain how.
A. Much of the work that -- that the NCI TWG program undertook over that 12- to 14-year period was trying to understand how cigarette design might reduce the risks of smoking, and they went back and evaluated experimentally a variety of the different types of general reduction techniques that we've discussed here today, they evaluated many of the selective reduction techniques that we've discussed here today, and more, they did extensive chemistry on the mainstream smoke, they did some biology, including mouse skin-painting tumorigenicity on all these prototypes, collected the data, tried to correlate chemistry with the biological observations, they tried to make some judgment about how one would go about, to use their words, developing a less hazardous cigarette.
Q. Did scientists from Reynolds participate in the National Cancer Institute's Tobacco Working Group?
A. Yes, they did. Dr. Murray Senkus was the first representative from Reynolds on the Tobacco Working Group, and then he was followed by Dr. Alan Rodgman.
Q. Were Drs. Wynder and Hoffmann involved with the

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National Cancer Institute's Tobacco Working Group?

A. Yes, they were. They were members.
Q. Were scientists from other tobacco companies involved?
A. Yes, as well as scientists from -- from universities as well.
Q. And were scientists from the National Cancer Institute involved?
A. Yes.
Q. Who headed up that program?
A. Dr. Gio Gori headed that program, and he was director of the National Cancer Institute.
Q. Of the National Cancer Institute's Cancer Prevention Program; correct?
A. Yes.
Q. Now could you start off by turning to page 44, and let -- I'm sorry, tab 44, which is Exhibit AZ000851, and let me ask you if you can identify that as report number one entitled "Toward Less Hazardous Cigarettes, The First Set of Experimental Cigarettes?"
A. That's correct. This is the first report from the NCI TWG program, summarizing the first round of experiments.
Q. And this is dated in -- was published by the government in 1976, if you look inside the cover

page?
A. The date is about right. I can't find the date on here though.
Q. Well if you look down at the last line on that inside first page, it says "DHEW Publication No.," and it's got the "NIH" --
A. Oh, yes, there it is, --
Q. -- number 76 --
A. -- seventy-six, report number 905.

MR. WEBER: Your Honor, I move AZ000851, the first report of the National Cancer Institute Tobacco Working Group, into evidence under 803(8).

MR. CIRESI: No objection, Your Honor.

THE COURT: Court will receive AZ000851.

BY MR. WEBER:
Q. Now sir, could you turn to tab 46.
A. Forty-six?

MR. WEBER: Your Honor, would it be all right with the court -- there are five of these reports -- if I could have them identifed as a group and move them in, just for time?

MR. CIRESI: We have no objection.

THE COURT: This would be fine. I see no problem with that.

BY MR. WEBER:

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Q. Could you go to tab 45, which is Exhibit GE000019, and that's the second report on the second set of experimental cigarettes?
A. That's correct.
Q. Could you go to tab 46, then, which is FX000201, --
A. Yes.
Q. -- and is that the report on the third set of experimental cigarettes?
A. Yes, it is.
Q. And if you'd go to the next tab, AZ001042, could you identify that as the report on the fourth set of experimental cigarettes?
A. That is report number four.
Q. And finally, if you would go to the last tab in that series, tab 48, and ask if you could identify that as AZ001047, that last report being the summary report, report number five, of the National Cancer Institute's Smoking and Health Program?
A. Yes, that is report number five of the NCI TWG.
MR. WEBER: Your Honor, I'd like to move into evidence on the same basis as the first report we moved in GE000019, FX000201, AZ001042, and AZ001047.
MR. CIRESI: No objection, Your Honor.

THE COURT: All right, court will receive GE00019, FX000201, AZ001042, AZ001047.
BY MR. WEBER:
Q. Now Dr. Townsend, I think I'm going to focus on summary report number five, but just so it's clear the extent of work that was done, first four reports, number one, number two, number three, and number four, constitute a substantial body, do they not, of research on experimental cigarettes?
A. Yes, they do.
Q. Who made the experimental cigarettes that were used in the National Cancer Institute's Tobacco Working Group's set of experiments?
A. Well the entire TWG group decided on the experimental plan. They laid out the -- the experimental program itself, and that included members -- the representatives from the tobacco industry as well as members from the universities and -- and also from the government. So collectively they decided what needed to be done. The tobacco industry, however, went back to various pilot plants and actually prepared these experimental cigarettes with very -- with the differences in cigarette construction.
Q. For example, if you'd turn to the first tab, tab

44, to the page -- fifth page in where it lists the members, do you see that?
A. Yes.
Q. And down at the lower right, does it reference who made the experimental cigarettes in that first

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set of experiments?
A. It does. The first set of experiments was made by R. J. Reynolds, and they said, "R. J. Reynolds Tobacco Company generously contributed expertise, labor, and raw materials for cigarette production."
Q. And were other companies also involved in later production of cigarettes for the National Cancer Institute?
A. Yes.
Q. Now let me turn to that fifth and last report, which is AZ001047, which should be at tab 48, if I'm correct. Is that the fifth report?
A. Yes.
Q. And could we put the cover page up there just for a moment. Now was this the last of the reports of the National Cancer Institute Tobacco Working Group reports?
A. It was the last report, but it wasn't the final report.
Q. And the last report with respect to these tests.

A. That's correct.
Q. Now if you'd turn to page two, Dr. Townsend, I'd like to ask you some questions.
A. Okay.
Q. And I'd like to go to that second paragraph now and read that with you. It says, "The National Cancer Institute, in coordination with the National Heart, Lung and Blood Institute and the Department of Agriculture, established the Smoking and Health Program to provide guidelines for the reduction of the risks of cigarette smoking. The program is advised by consultants representing a wide spectrum of disciplines." Do you see that?
A. Yes.
Q. And was that one of the purposes of the NCI Smoking and Health Program?
A. Yes.
Q. Now if you'd go to that next paragraph where it says, "A systematic approach has been taken toward the development of less hazardous cigarettes, one of the principal objectives of the Smoking and Health Program. The first phase of this Program involved the design of a variety of experimental cigarettes and the chemical and biological analyses of their condensate and smoke."

And was that also one of the purposes of the National Cancer Institute Tobacco Working Group?
A. Yes, it certainly was.
Q. Now when they were testing these various cigarettes --
Some of which were low yield or lower yield cigarettes; is that correct?
A. Some were, yes.
Q. -- did they test them on a gram-for-gram -- the tar on a gram-for-gram, equal-weight basis?

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A. The biology, the biology was in fact evaluated on a gram for gram, so we call that specific activity, so the results were reported in terms of activity per milligram of tar to -- to keep everything on a comparable basis.
Q. Now --
And again, this is the summary report; correct?
A. Yes.
Q. I'd like you to come down to the middle of that next paragraph, the sentence that begins "The ultimate objective...." Do you see that?
A. Yes.
Q. Let me read that to you and I want to ask you a question. "The ultimate objective for these experiments is to identify the characteristics of

less hazardous cigarettes that will serve as guidelines for future commercial cigarettes. Success is hindered by the uncertain relationship between tumors resulting from mouse skin painted with condensate and human lung cancer and by the virtual absence of information on the cardiovascular and respiratory effects of these cigarettes, paren, beyond the permissible inferences from their physical and chemical characteristics, close paren, period."
What does that sentence tell you about the position of the National Cancer Institute in 1980 as to whether or not mouse skin-painting established a causal link between cigarette smoking and human cancer?
MR. CIRESI: Your Honor, number one, this witness is not qualified to testify in that area; secondly, it calls for a conclusion as to the state of mind of the NCI on incomplete tests.
THE COURT: Sustained.
BY MR. WEBER:
Q. Now in this summary report, did the NCI report on high porosity paper; that is, tar from cigarettes with high porosity paper?
A. Yes.
Q. And do you recollect what the results in the

mouse skin-painting were from those experimental cigarettes as opposed to the reference cigarette used?
A. I think specific activity for the higher porosity papers was a bit lower.
Q. And for reconstituted sheet?
A. For reconstituted sheet, the mouse skin-painting specific activity was substantially lower.
MR. CIRESI: Your Honor, I'm going to move to strike that. There's no foundation yet as to what cigarettes were used, whether these were commercial cigarettes or experimental.
THE COURT: Can we lay some foundation for that area?
BY MR. WEBER:

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Q. You mentioned earlier, with reference to the first report, the second report, the third report and the fourth report, that each report dealt with experimental cigarettes; did you not?
A. That's correct.
Q. And in each one of these reports, do they discuss the nature of the experimental cigarettes that were prepared?
A. They do, in detail.
Q. Was one set of the experimental cigarettes that

was measured against a reference cigarette cigarettes which had, for example, reconstituted sheet?
A. That was the comparison that was made.
Q. Could you turn -- let me find the page. Could you turn to page 12 of report five.
A. Okay.
Q. And I'd like to focus you on the paragraph under "General Summary...." Does --
Could you read that second paragraph that begins "Several significant findings...?"
A. Sure.
MR. CIRESI: Excuse me, doctor, one moment, please. Your Honor, may -- may we have foundation as to which cigarettes this report relates to? Are these experimental cigarettes or commercial cigarettes?
THE COURT: It is a little ambiguous if these are the results of experimental cigarettes or the commercial cigarettes. Maybe you could answer that question before you get to the results.
BY MR. WEBER:
Q. Did the experimental cigarettes used in the NCI TWG testing incorporate various design modifications?
A. They did.
Q. Was one of the modifications air dilution?

A. That was one.
Q. Was one reconstituted sheet?
A. That was another.
Q. And were there a number of other --
High porosity paper?
A. That was another one.
Q. And were experimental cigarettes of that type tested against the reference cigarettes?
A. That's correct, they were.
Q. And were those reports included in the NCI's one, two, three, four reports and then summarized in the fifth?
A. In detail it was included in there.
MR. WEBER: I just want him to read the summary of the document that's in evidence, Your Honor.
MR. CIRESI: Your Honor, we still don't know whether any of the cigarettes, the reference cigarette or these experimental ones, were actual commercial cigarettes.

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THE COURT: Yeah, I don't understand myself. Can't we just answer that question simply? It's a simple question.

MR. WEBER: I think -- I think I'll do it just that way, Your Honor.

THE COURT: Okay.

BY MR. WEBER:

Q. The reference --

The reference cigarette was a standard experimental blend; correct?

A. The reference cigarette was an experimental blend, was a conventional type, but still was not a commercial product.

Q. It was a reference cigarette.

A. It was a reference cigarette for control purposes.

Q. And then the reference cigarette was measured against various experimental cigarettes; correct?

A. That's correct. The TWG designed, and then the industry would construct cigarettes according to that design, incorporated those cigarette design modifications. Those products, those experimental products were compared back to that reference.

Q. And could you read that paragraph that begins "Several significant findings...?"

A. Yes. It says, "Several significant findings were obtained from the first experiment. Cigarettes made with high-porosity paper, those made of tobacco stems only, and those made with reconstituted sheets all provided condensates found to be less tumorigenic

to mouse skin than SEB I." And SEB I is the control. "Neither the width of tobacco cuts nor the doubling of nitrates content to SEB I appeared to affect the condensate tumorigenicity, but cigarettes made of tobacco laminae only were so toxic to the mouse that the skin-painting with their condensate had to be discontinued."

Q. Now, would you turn for a moment -- I want to come back to this document, but would you turn for a moment to the 1989 Surgeon General's report, PX3821 at page 398.

A. I'm sorry, which page?

Q. Page 398 of the 1989 Surgeon General's report. Or perhaps -- I need to check in my --

The copy I have looks like page 396. It begins with --

No, it's -- 398 is the one I want.

MR. CIRESI: Do you want to use this one?

MR. WEBER: If I could look at that quickly. I'm pretty sure it's 398. Yeah, with the heading "National Cancer Institute."

Thank you.

MR. CIRESI: You're welcome.

BY MR. WEBER:

Q. Does this paragraph discuss the National Cancer

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Institute's involvement in the Tobacco Working Group?
A. Yes, it does.
Q. Let me read this to you, then I want to ask you a question. "In the 1950s, scientists working at the NCI were among those who helped identify cigarettes as a cause of illness and premature death," citation. "In 1955, NCI, in cooperation with the U.S. Bureau of the Census, sponsored the first large-scale national survey of smoking patterns in the United States," citation. "It was not until 1968, however, with the appointment of the Lung Cancer Task Force that NCI established a formal research program to address the smoking issue. The Lung Cancer Task Force and a subcommittee of the task force, the Tobacco Working Group, established three objectives for the program:
"(1) production of a less-hazardous cigarette,
"(2) identification of persons at increased risk of tobacco-related disease, and
"(3) development of pharmaceutical interventions to control smoking behavior.
"Development of a less hazardous cigarette was given a high priority until 1978, when this aspect of the program was abandoned."
Now who was it who ended the cooperative effort

between industry and the government and the Tobacco Working Group?
MR. CIRESI: Excuse me, Your Honor, there's to foundation for this witness to testify to that.
THE COURT: Oh, you may answer if you know.
A. It was the government.
Q. Now let me take you back for a minute to that fifth report which we were just looking at, I think that's tab 48, and go to that page marked two.
A. Okay.
Q. And let me ask you this: Remember, we talked earlier about how this document of the National Cancer Institute notes that one of the reasons of the Smoking and Health Program was to provide guidelines for the reduction of the risks of cigarette smoking? Do you see that?
A. Yes.
Q. Had the National Cancer Institute provided those guidelines prior to the time the government abandoned the program?
A. No. There was no final report when the government in fact terminated this program.
Q. Now did Dr. Dietrich Hoffmann state on the record at the National Cancer Institute's conference on the FTC method the reason for the government's

abandonment of this program in 1978?

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A. Yes, he did. He said it was purely politics.
Q. Now during the existence of the Tobacco Working Group and that cooperative effort for that period of years, and prior to the government's abandonment of this effort, did the National Cancer Institute scientists make suggestions to Reynolds and others about changing design modifications in cigarettes?
MR. CIRESI: Objection to the form of the question.
MR. WEBER: I can rephrase it, Your Honor.
THE COURT: Why don't you, please.
MR. WEBER: Okay.
BY MR. WEBER:
Q. During the time in which the Tobacco Working Group was in existence, did scientists at the National Cancer Institute who are participating -- who were participating in that effort make suggestions about cigarette design to the companies, including Reynolds?
A. The cigarette designs that were evaluated by the Tobacco Working Group came from the industry representatives. I'm not aware of any design ideas that came from NCI or from outside of the industry representatives.

Q. Were there times in those meetings of the Tobacco Working Group where the NCI scientists came up with ideas for the industry to pursue?
A. I'm sorry. Can you repeat that, please?
Q. Sure.
Were there times during the meetings of the Tobacco Working Group when the NCI representatives would come up with ideas for the companies to think about or pursue?
A. Well I think there was a healthy discussion, from the minutes that I've seen of the meetings. I think there's been healthy discussion over the entire time of that. There were ideas back and forth. The designs that were evaluated in the experiments, I think, were -- were designs, however, that had come from the tobacco industry.
Q. Let me turn you to tab 49, AZ000993. Ask if you can identify that document.
A. Yes. This is minutes of meeting of the National Cancer Institute's Tobacco Working Program, May the 5th, 1976.
Q. Were these minutes prepared by the National Cancer Institute?
A. Yes.
MR. WEBER: Your Honor, I'd move these --

I'd move AZ000993 into evidence under 803(16) as an ancient document or under 803(8) as a government report.
MR. CIRESI: Is this a complete copy, counsel?
MR. WEBER: It's a complete copy of the

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minutes, yes. It references an attachment to it that I don't have. But for the minutes, it's complete.

MR. CIRESI: Well we'd like the entire document, Your Honor. And I don't know if it's the end, the last page is page three here. We have no objection to the document as a complete document.

THE COURT: Okay. Do we know what the attachment was?

MR. WEBER: I do not know. All I --

This is the document that was filed at Reynolds in the Tobacco Working Group materials. There is no attachment with it. It says that there is an attachment, a protocol for other testing, but in terms of the minutes of the meeting, this -- these are the minutes of the meeting.

THE COURT: Well when minutes refer to attachments, then it should be complete. Can we get --

Is that available to us?

MR. WEBER: I don't believe it is, Your Honor. I made inquiry about that.

THE COURT: Anyone know what it is?

MR. CIRESI: Well one of the problems, the way they produce the attachments, many times it's detached. That's why we want the whole document, Your Honor.

MR. WEBER: I'm not -- for purposes of this, I don't want to refer --

It's clear what the attachment is, Your Honor, in the sense that it talks about a way to build other cigarettes. I'm not going to get into that issue at all. All I want to go into here is what the minutes report the National Cancer Institute as saying.

THE COURT: I know what you want, but -- but if there is -- if they refer to an attachment, it's referred to in the body, then for the document to be complete it should have the attachment.

Can you check to see if you have that available? Then we can --

MR. WEBER: I will. I will recheck on that, Your Honor.

THE COURT: Okay. Maybe we can take a short recess at this time then.

THE CLERK: Court stands in recess.

(Recess taken.)

THE CLERK: All rise. Court is again in session.

(Jury enters the courtroom.)

THE CLERK: Please be seated.

THE COURT: For the record, the exhibit TX 13017, the objection of the defendants is overruled and that will be received. Exhibit TX 11952, the objection of the defendants is sustained. And as to TX 21504, that will be received in a redacted form. And for the -- as to the redactions in the document,

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the jury is instructed not to concern themselves about the redactions, those have been made by the court as a matter of law.

Let's proceed.

MR. WEBER: Thank you, Your Honor.

BY MR. WEBER:

Q. Dr. Townsend, based on your review of the Tobacco Working Group reports on the experiments, do you have an understanding how the experimental cigarettes differed from the reference cigarettes?

A. The experiment -- I'm sorry.

(Witness turns his microphone on).

THE WITNESS: Excuse me, Your Honor.

A. The experimental cigarettes were designed to be

the same as the control or the reference cigarettes, only with one exception, and that was the design variable that was under consideration. So, for example, the evaluation of reconstituted tobacco, that was incorporated in the blend, whereas the experimental tobacco -- I mean -- I'm sorry, the reference tobacco was made in the same manner but only without the reconstituted tobacco.

Q. Based on your review of Tobacco Working Group minutes, do you -- are you aware of whether the National Cancer Institute scientists made suggestions to the tobacco companies about ways to modify cigarettes so as to make them less hazardous?

MR. CIRESI: Objection, asked and answered.

THE COURT: No, you may answer that.

A. I'm aware that in the course of discussions there were a number of ideas and suggestions that went both ways, so yes, I do believe that the National Cancer Institute made suggestions to the tobacco industry.

Q. Was there any time during the course of the Tobacco Working Group when representatives of the National Cancer Institute suggested that the manufacturers consider raising the pH of their cigarettes?

MR. CIRESI: Your Honor, I'm going to object to the leading nature of the question. It also relates to an exhibit that's not in evidence.

THE COURT: Okay. Is there an exhibit that you're going to be introducing, counsel?

MR. WEBER: Not at present. I'm just asking from hisd review of minutes, Your Honor.

THE COURT: Sustained.

BY MR. WEBER:

Q. Could you turn to tab 33, Dr. Townsend. That's already in evidence as GJ000043.

A. Yes.

Q. Okay. And this is that article from the Journal of the National Cancer Institute in 1972 that you referred to earlier entitled "Sugar Content of the Tobacco and pH of the Smoke in Relation to Lung

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Cancer Risks of Cigarette Smoking?"
A. That's correct.
Q. I'd like to turn you to page 1888, left-hand column beginning with "Since...."
A. Yes.
Q. And this is a 1972 article in the Journal of the National Cancer Institute; correct?
A. That's correct.
Q. Could you read that paragraph, over onto the

next page. And I know it's a long one, and I'm going to stop and ask you some questions as you go along.
A. Yes. "Since the satisfaction derived from smoking is partially due to the pharmacological effects of nicotine, the lower incidence of lung cancer in smokers of cigars & pipes and, we suggest, in smokers of air-cured tobacco (low sugar content) cigarettes may be related to the fact that nicotine is more readily absorbed in the form of the free base [at alkaline pH (7 to 9) than in the form of a stable salt at acid pH (5 to 4)]. To obtain the same degree of 'nicotine satisfaction' as in cigar or cigarillo smoking, the smoker of cigarettes giving an acid smoke would tend to encourage more prolonged and extensive contact of the smoke with the mucous membranes of the mouth and bronchus and to take the smoke into his lungs, which would thus suffer greater exposure to the carcinogenic effects of the smoke than the lungs of the smoker of cigars or low sugar cigarettes. This difference is accentuated by the fact that the smoke of the high sugar cigarettes becomes more acid during smoking and is most acid toward the end of the smoking when the tar content of the smoke is also the highest. The absorbability of the nicotine thus becomes progressively less and the

tendency to inhale to keep up 'nicotine satisfaction' is greatest at a time when the tar content of the smoke is also at its highest level."
Q. Let me stop you there, Dr. Townsend, and -- and ask you: Does this article in the Journal of the National Cancer Institute in 1972 refer to free base nicotine?
A. Yes, it does. It refers to both free base and salt nicotine.
MR. CIRESI: Excuse me, Your Honor, there's no expertise on the part of this witness to testify to these matters.
THE COURT: Well I think you can answer that question.
Q. Would you like the question again, Dr. Townsend?
A. Yes, please.
Q. Does this article in the Journal of the National Cancer Institute in 1972 refer to free base nicotine?
A. It does refer to free base nicotine, and then defined that as alkaline pH seven to nine.
Q. All right. I think we were down at the bottom

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of the page, "With cigarettes...?"
A. Yes. "With cigarettes made from air-cured, low sugar tobacco, the smoke becomes progressively more alkaline and the absorbability of the nicotine thus

increases during the course of smoking so that the tendency to inhale is least at the period when the tar content of the smoke is at its maximum."
Q. And the next paragraph.
A. "If we can consider that the smoking of cigarettes made of 'cigar-type,' low sugar content tobacco may, for reasons mainly connected with less 'compulsion to inhale' involve less risk of lung cancer than the smoking of cigarettes made chiefly of flue-cured, high sugar content tobacco, what then are the implications for a less harmful cigarette? Apart from replacing flue-cured tobacco by air-cured, low sugar tobacco, which in the form of cigarettes probably would not be readily acceptable to the majority of the smoking public, one suggestion would be to raise the pH of the smoke of cigarettes containing flue-cured tobacco. One way to accomplish this would be by additives that would give rise to an alkaline vapor at the usual temperature of combustion of cigarettes."
Q. Now Dr. Townsend, let me stop you there. What's the --
What do you understand the author to be talking about from the standpoint of cigarette design?
A. From the standpoint --

MR. CIRESI: Excuse me, doctor. Your Honor, this witness is not qualified to testify to the importance or relevance of exposure to chemical compounds. There's no foundation for the testimony.
THE COURT: I don't believe that was the question.
You may answer.
A. Could you ask the question again, please?
Q. Sure. Let me look here.
What do you understand the author to be talking about from the standpoint of cigarette design, Dr. Townsend?
A. My understanding of this whole discussion that I just finished reading is that -- is that a reduced risk or a safer cigarette might be one that would have the pH increased by adding something alkaline to the cigarette that would make that cigarette less inhalable.
Q. Now could you turn to -- so let --
Let me go back a step. So at least as of 1972, the Journal of the National Cancer Institute was discussing a means of designing a less-hazardous cigarette; correct?
A. That's absolutely correct.
Q. And that dealt with -- at least in part with pH;

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correct?
A. That was one approach that's considered here.
Q. Now could you turn to tab 33, and that is AZ008283.
A. Tab --
Q. Thirty-three. Let me -- I'm sorry, tab 50. That was my mistake. I read my notes wrong.
MR. CIRESI: Do you have the number of that?
MR. WEBER: I think I got the number right, AZ008283.
A. Okay.
Q. Can you identify this document?
A. This is an R. J. Reynolds memorandum from Dr. Murray Senkus to Dr. Andy Laurene.
Q. And it's dated --
A. Both -- both are researchers at R. J. Reynolds Tobacco Company.
It's dated November 9th, 1976.
Q. Was this document created and maintained in the regular course of Reynolds' business?
A. Yes.
MR. WEBER: Your Honor, I'd move the admission of this document under 803(16) as an ancient document.

MR. CIRESI: It's a business record of Reynolds; is it not?
MR. WEBER: I'm sorry?
MR. CIRESI: It's a business record of Reynolds.
MR. WEBER: Yeah.
MR. CIRESI: Yeah. No objection, Your Honor.
THE COURT: Court will receive AZ008283.
BY MR. WEBER:
Q. Now let me see if I can get this in --
Now is this memorandum one in which Dr. Senkus is reporting on a meeting of the Tobacco Working Group?
A. Yes, it is. He was reporting on the Tobacco Working Group, and it -- he was reporting specifically on the Tobacco Working Group meeting of November 5th, 1976.
Q. Now could you come down to the paragraph that starts "Dr. G. Gori...," do you see that?
A. Yes.
Q. And that's the Dr. Gori who was the director of the Smoking and Health Program for the National Cancer Institute?
A. That's correct. That's Dr. Gio Gori from the

National Cancer Institute.
Q. Can you read through that introduction and then

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through numbers one through eight.
A. Yes. "Dr. G. Gori," standing for Gio Gori, "the Director of the program concludes on the basis of the work to date, that the following properties of a cigarette provides safer smoking"
"1. Use of high porosity cigarette paper.
"2. Large proportion of reconstituted tobacco and stems in the blend.
"3. Extraction of tobacco with a suitable combination of hexane, water, and detergent.
"4. Use of inert fillers as tobacco extenders.
"5. Use of tobacco varieties from selected culture and curing methods.
"6. Reduced nicotine, and especially reduced tar.
"7. Use of air-dilution filters."
And number eight, "Use of flavor additives to insure acceptability."
Q. Now with respect to those eight properties mentioned by Dr. Gori, had at this point, 1976, Reynolds either incorporated or researched each one of those?
A. That's correct, every one.

Q. Was high porosity paper in use at that time?
A. It was in the commercial market at that time.
Q. Reconstituted tobacco?
A. Reconstituted tobacco had been in the commercial market for some time.
Q. What about -- is --
Is extraction with hexane, is that the matter you spoke about earlier?
A. It is. Hexane is one of the solvents we evaluated, and of course we found that not to -- not to be a practicable approach. Technically it did reduce benzpyrene, but not a practical approach.
Q. And what did the Surgeon General say with respect to the hexane extraction in 1979?
A. Well to extraction in general, he said that that was of academic interest only.
Q. Number four, use of inert fillers, does that relate to substitutes of one type or another?
A. Yes, it does.
Q. Number five, use of tobacco varieties from selected culture and curing methods, --
A. That's correct.
Q. -- what does that refer to?
A. Well that refers to actually some of the work that we've done at Reynolds, and I think some of our

competitors have done as well, looking at -- at modification of tobaccos or even altering the curing practice of tobacco to try to change the chemistry and -- and reduce the risk of smoking.
Q. Was there a doctor from the Department of Agriculture who was part of the Tobacco Working Group?

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A. Yes. Dr. T. C. Tso from USDA was a long-term member of the Tobacco Working Group. He's also been involved in a variety of tobacco science exchanges including Tobacco Chemist Research Conferences, CORESTA, and -- and is still active in the industry although he's retired from USDA.
Q. How about seven, air-dilution filters?
A. The use of air-dilution filters was in place in the market at this time.
Q. And I went over reduced nicotine and especially reduced tar. What does that mean to you?
A. To me that means that reduced tar and nicotine cigarettes, to use Gori's terms, may provide safer smoking. The "especially reduced tar" to me means that the risks of smoking are probably tied up primarily in the tar phase, and if -- and -- and, you know, and that's what we've been trying to do in selective reduction and general reduction, is reduce

the exposure to tar. So I think Gori acknowledged that, that the -- the risks of smoking are probably related to the tar phase.
Q. And the last one, use of flavor additives --
MR. CIRESI: Excuse me. Move to strike the last portion as calling for speculation.
THE COURT: Sustained.
Q. Use of flavor additives.
A. Yes.
Q. Now let's go on to the next page, doctor. And it notes in the introduction that Dr. Gori defined minimal risk limits for daily intake of smoke constituents?
A. Yes.
Q. Can you explain what that means.
A. Yes. And actually Dr. Gori published a paper that outlined this in a lot more detail in Science, a journal article. And Dr. Gori essentially outlined what he terms critical values for daily exposure to a number of things, including tar level, nicotine level, nitric oxide in smoke, hydrogen cyanide, acrolein, and carbon monoxide, and essentially the Gori -- the Gori's -- Dr. Gori's approach to this was if a smoker maintained overall daily exposure levels below these critical values, then that smoker

wouldn't run a statistically significant increased risk of lung cancer.
Q. Now let me move from the Tobacco Working Group for a moment and go to the subject of the Banbury conference.
A. Yes.
Q. You'll remember earlier that you referred to the Banbury conference, and its proceedings were admitted into evidence as GJ000107, and that's at tab 25. That was the document that was issued as Banbury Report 3; correct, doctor?
A. That's correct.

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Q. Now what was the Banbury conference?
A. It's a conference -- it was a conference held in -- in 1979 that actually -- where a number of scientists came together to discuss whether or not it was possible to develop a safer cigarette, what progress had been made toward developing a safer cigarette. There were a number of technical discussions as well as discussions on cigarette design as well as discussions about epidemiology and the risks of smoking.
Q. Did the Banbury report reach any conclusions about the role of consumer acceptance in cigarette design?

A. It did very directly, and in the summary of -- of this -- this book, speaks directly to it, and the opinion was that --
MR. CIRESI: Excuse me, Your Honor, if he's giving an opinion from a book, can we see the page, please?
MR. WEBER: I can show him the document, Your Honor. Hang on just a minute, sir. Okay. Is --
BY MR. WEBER:
Q. Could you turn to the first -- I think it's the first article in the book. Is that an article by Dr. Ernst Wynder entitled "Some Concepts of a Less Harmful Cigarette?" Page three.
A. Yes.
Q. All right. Could you turn to page six of Dr. Wynder's article and focus on the paragraph labeled "Fifth..." --
A. Yes.
Q. -- in Dr. Wynder's report.
A. Sure.
Q. And does Dr. Wynder there express an opinion in the Banbury -- at the Banbury conference with respect to consumer acceptability of cigarette modification?
A. He certainly does.

Q. Could you read that, please.
A. "Fifth, as a practical matter, it is important to appreciate that a virtually harmless cigarette smoked by only one percent of the population will have a lesser impact on the reduction of tobacco-related diseases than a somewhat more harmful cigarette smoked by 80 percent of the total smoking population. Research on the less harmful cigarette should therefore be directed toward developing a cigarette containing the lowest possible amount of harmful elements for all tobacco-related diseases, but one that has sufficient acceptability for the largest segment of smokers."
Q. Now what's the significance of that observation to you as a cigarette designer with respect to whether or not the issue of consumer acceptance of modified designs is important?

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MR. CIRESI: Objection, Your Honor, there's no connection one to the other. There's no foundation for that.
THE COURT: Well you can answer that.
A. Can you ask the question again, please?
Q. Sure. What is the significance of that observation to you as a cigarette designer with respect to whether or not the issue of consumer

acceptance of modified designs is important?
A. Well as a cigarette designer, it -- the significance is -- is very clear. Cigarette modification has to be consumer acceptable if you're to make any progress in the market -- in the marketplace in reducing the risks of smoking. Consumer acceptance is critical.
Q. Now could you turn to tab 52 in your notebook, which is X2658.
MR. CIRESI: I'm sorry, may I have that number again?
MR. WEBER: X2658.
MR. CIRESI: Are we leaving the Banbury conference? I thought there was going to be -- there was a question regarding conclusions of the conference; that's why we went to the document.
MR. WEBER: Well I just asked him one question, Your Honor. I'm about to ask another.
MR. CIRESI: Oh. We're done with this then?
MR. WEBER: No. This is in the Banbury report.
BY MR. WEBER:
Q. And is X2658 a quote from Dr. Dietrich Hoffmann in the Banbury report?

A. Yes, it is.
MR. WEBER: Your Honor, I'd move the admission for demonstrative purposes of X2658.
MR. CIRESI: Your Honor, we have again some editorial comment on the left-hand side.
THE COURT: Can we eliminate the editorial comment, counsel?
MR. WEBER: Okay. Let me go to that page, if I can.
BY MR. WEBER:
Q. Could you turn to page 174 of the Banbury report, please.
A. I'm sorry, that was tab --
Q. Tab 25.
A. Tab 25, page 174.
Q. And does --
Is this a discussion among the conference participants about risk reduction achievements?
A. It is. Title of this section is "Risk Reduction Achievements." There's a number of exchanges among the scientists reported here.
Q. And does Dr. Hoffmann comment here about the

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responsiveness of the United States industry to scientific concerns in the second paragraph?
A. Yes.

Q. All right. Let me put that up. That's Dr. Dietrich Hoffmann speaking. Could you read that paragraph "As Dr. Wynder stated...?"
A. Sure. "As Dr. Wynder stated, when we started, filtered brands comprised 5 percent of the cigarettes on the market. Today they are 90 percent of the -- of the market. The perforated filter significantly reduces CO," carbon monoxide. "Five years ago, it was zero percent of the market. Today it comprises 20 percent of the U.S. market. I do think the tobacco industry, voluntarily or not, adjusts very well to the demands of the logical reasoning of the scientific community and that we should continue on this path."
Q. Now could you turn to page 47 from the Banbury report, and is this part of a conference discussion on the issue of non-detectible risk levels?
A. That is the title of this section.
Q. And were the participants there discussing the presentation by Dr. Gori from the National Cancer Institute about whether there were non-detectible risk levels?
A. That was the subject of this discussion.
Q. Now I'd like you to first read Dr. Wynder's comment. I'll have to -- there on page 47, and I

want to ask you a question about it.
A. Sure. "Well, I think this is a difficult area that has been widely misunderstood by the public and one can understand why. First of all, when you take an individual who smokes two cigarettes or three cigarettes a day, that is already an unusual kind of smoker. I don't know how much he or she inhales, because that's the kind of person who smokes after a filet mignon with sauce bernaise to make sure the cholesterol is properly absorbed. And to draw a major conclusion from this to the one who gets supposedly an equal amount of tar and nicotine by smoking many more cigarettes is a very difficult jump.
"Also, we need to recognize -- not always in terms of inhalation -- that the person who smokes 17 low tar (5 milligrams) cigarettes a day, will cause a more continuing insult to the respiratory epithelium than one who smokes only two or three cigarettes a day. For the latter type of smoker, it is possible that the cilia can more readily recover than from more prolonged and continuous insults.
"From a scientific point of view, all these considerations should make us as conservative as possible vis-a-vis dissemination of information to

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the public. As Dr. Gori knows, I believe that we must be extremely careful in the type of data we present publicly because without a full understanding of the various scientific provisos we make, the information can easily be misunderstood by the public. In terms of providing information about the less harmful cigarette and what we may think of as threshold levels, it is difficult scientifically, and almost impossible politically, to discuss these concepts in terms that everyone will understand."
Q. Now, I'd like you to also read Dr. Bock's comment. Is that Dr. Bock from the Roswell Park Cancer Institute?
A. That is Dr. Fred Bock.
Q. And was he one of the co-editors of the Banbury report?
A. Yes.
Q. Would you read what he had to say after that comment of Dr. Wynder's.
A. Yes. "I would like to take some issue with Ernst (Wynder) on this, because it seems to me that the history of changes in the types of cigarettes consumed in this country follow pronouncements by various scientific groups regarding the desirability of changing smoking patterns. The issue of the

safety itself will bring about changes that can lead to further support of the conclusions reached.
"Wynder reported in 1955 that there was indeed a substantial dose-response effect in cigarette smoking. If one were to cut the total amount of tar delivered to an exposed organism, the response would be different. This wasn't proven until long after Wynder made that statement. It was proven by us."
Q. Now, with respect to Dr. Bock's statement in which he says the history of changes and the types of cigarettes consumed in this country follow pronouncements by various scientific groups regarding the desirability of changing smoking patterns, what is the significance of that statement to you as a cigarette designer?
A. As a cigarette designer, the significance to me is that consumers, smokers, do look to pronouncements from the government, from the scientific community, and respond. One example that we've already talked about today is the response to carbon filtered cigarettes. Smokers responded very quickly to carbon filtered cigarettes even though they had very different taste and over the long term weren't acceptable. They responded at that time to a Reader's Digest article.

Q. Now we've seen some examples so far of suggestions from the Journal of the National Cancer Institute, Banbury report and other sources regarding
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research in design for cigarettes that reduce nicotine but particularly reduce tar; correct?
A. That's correct. There are many references to that.
Q. Could you explain in a little more detail the theoretical basis from the cigarette design standpoint underlying this concept of reducing nicotine but particularly reducing tar.
A. Well again --
MR. CIRESI: Your Honor, if he's going to get into any biological significance, then he doesn't have the expertise to.
THE COURT: I don't think the question called for his involvement in the biological impact. Go ahead.
THE WITNESS: Thank you, Your Honor.
A. As we talked about earlier this morning and also on Friday afternoon late, cigarette-smoke tar is a very complex mixture of constituents, and most of those constituents are present at very, very low levels. We also -- I think I've made it very clear that cigarette smoking is a risk of a number of

diseases, and it's thought that the risk relationship between cigarette smoking and those diseases is probably a result of -- if -- is -- is -- is related to the chemistry of the tar, and that's why R. J. Reynolds and my competitors have been through the selective reductions to try to address the smoking-and-health issues, the general reductions to try to address the smoking-and-health issues, and reduction of tar exposure is the general reduction approach. Maintaining consumer acceptance, however, as tar and nicotine levels are -- are decreased further and further and further becomes difficult, and so the theory that's been expressed in that document and a number of others is to maintain nicotine levels at some level that would maintain consumer acceptance, reduce the tar level further, as low as you can go, and still maintain consumer acceptance. So that was the theory.
Q. Now were there suggestions from others in the scientific community outside the tobacco industry about designing cigarettes that changed the tar-to-nicotine ratio?
A. Yes, there were a number of them.
Q. Could you turn to tab 53, and that's document AZ000828, and is that a 1973 article by Russell, et

al, in the British Medical Journal in 1973?
A. That's correct. This is an article by Dr. Mike Russell in the British Medical Journal. The title of it's "Comparison of the Effects on Tobacco Consumption and Carbon Monoxide Absorption of Changing to High and Low Nicotine Cigarettes."
Q. And is this a document --
Does this document contain observations and data

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on which you reasonablely relied regarding possible cigarette design modification?
A. Yes, it certainly does.
MR. WEBER: Your Honor, I'd move AZ000828 under 803(18).
MR. CIRESI: Your Honor, this is a '73 article. I don't believe the doctor was at Reynolds in '73 designing cigarettes.
THE COURT: Court will receive AZ000828.
BY MR. WEBER:
Q. Let me just show you the cover page of that article, doctor. And that's the article we just referred to?
A. That's correct.
Q. Now if you'd turn to page 516, the last page of the article, paragraph that starts on the bottom left-hand column, begins "But what about overall

safety?"
A. Yes.
Q. Does Dr. Russell set forth some thoughts and observations there about changing cigarette design?
A. He certainly did.
Q. Could you read that for us.
A. Yes.
Dr. Russell says, "But what about overall safety? Apart from other factors such as the pH of the smoke, the sugar content, and the method of curing of tobacco which are not the concern of this study, our findings suggest that for heavy smokers a cigarette would be less harmful if it combined the qualities of the low -- of the low nicotine and the high nicotine brands by having a low tar and CO yield but a high, rather than low, nicotine yield."
Q. Now what is doctor --
What is that article suggesting to you as a cigarette designer?
A. He's suggesting a product that maintains some acceptable levels of nicotine, but reduces the tar level as low as one can and still maintain consumer acceptance.
Q. Now Dr. Russell, by the way, he's a researcher who believes in compensation and the addictiveness of

smoking; is he not?
A. Oh, he certainly does.
Q. Let me turn to page -- tab 55 now, AZ000998.
MR. WEBER: That's a document, Your Honor, for the record, that was previously admitted under GI000027 under 803(18).
Q. And can you identify that as an article in the journal Science by Dr. Gio Gori in December 1976?
A. Yes, that's correct.
Q. And the title of the article?
A. "Low-Risk Cig" -- excuse me -- "Low-Risk Cigarettes: A Prescription."
Q. And at this time Dr. Gori was -- he was deputy

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director of the Division of Cancer Cause and Prevention, and director of the Smoking and Health Program at the National Cancer Institute?
A. That's correct.
Q. All right. If we could turn your attention, doctor, to the paragraph that begins with the word "Because...," about halfway down the right-hand column.
A. Yes.
Q. And I'd like for you to read that and I'll -- I'll have a few questions for you as you go along.
A. Okay. Dr. Gori says, "Because of its

overwhelming pharmacologic contribution, however, nicotine plays an important role in controlling smoking behavior. Within smoke the alkaloid exists in both the protonated and unprotonated forms."
Q. Let me stop you there. What is Dr. Gori referring to when he says "within smoke, the alkaloid exists in both protonated and unprotonated forms?"
A. What Dr. Gori is referring to is in the smoke, the alkaloid, meaning nicotine, exists in both free form or free nicotine form as well as the salt form.
Q. And "protonated" refers to --
A. "Protonated" refers to the salt form.
Q. And "unprotonated" refers to?
A. The free nicotine form.
Q. All right. Proceed, would you, doctor?
A. Yes. "The latter form," meaning the unprotonated or free form, "increases with increasing alkalinity of the smoke (reference 27, 28) and appears to be more readily absorbed; more important still, it has decidedly satisfying effects on the smoker's taste receptors (reference 28). Within certain value ranges, high levels of nicotine, high smoke pH values, and high ratios of unprotonated to protonated nicotine increase the satiation effect in the smoker, tend to depress the consumption of

cigarettes and the depth and frequency of inhalation (references 26 and 29), and therefore reduce the intake of smoke."
Q. Now let me ask you here: Is that the same general point that was made earlier in the 1972 Journal of the National Cancer Institute article about -- talking about raising smoke pH?
A. It's generally the same point, that's correct.
Q. Now, could you continue with the next paragraph.
A. "Thus it appears that the hazards of cigarettes can be reduced by a simultaneous reduction of tar and of its specific carcinogenic activity; by a reduction of carbon monoxide, nitrogen oxides, hydrogen cyanide, acrolein, and other undesirable toxic smoke constituents" -- or I'm sorry, "components; and by an adjustment of nicotine levels and protonation conducive to consumer satisfaction."
Q. Now in this article in 1976 by the director of

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the Smoking and Health Program of the National Cancer Institute, what is it that he's referring to in that last clause where he talks about how the hazards of cigarettes might be reduced by an adjustment of nicotine levels and protonation conducive to consumer satisfaction? What does that refer to?
A. Well what he referred to in the words before,

that he was essentially suggesting that the tar constituents be reduced, and he named those constituents that he felt ought to be reduced, and adjusting nicotine levels, meaning maintaining those levels at consumer acceptable levels, and also adjusting pH to maintain consumer acceptance.
Q. Now if you can go on to the next paragraph, Dr. Townsend.
A. "The technology to achieve these results has been developed and can be applied to the manufacture of commercial cigarettes," and there's a number of references. "Not surprisingly, such manipulations after traditional flavor patterns and produce -- and produce various degrees of conflict with established standards of acceptance. The problem, however, is not insurmountable, because consumer perception can be made to change. For instance, the strength of cigarettes today is nearly half of what it was 15 years ago, when modern cigarettes would have been considered too weak (reference 30). There may be lower limits of acceptability, and the success of some new cigarette brands, containing 2 to 8 milligrams of tar and .2 to .8 milligrams of nicotine, indicates that these limits might be quite low. Future commercial cigarettes can be expected to

challenge consumer acceptability and to call for cautious marketing policies. These new cigarettes will utilize compensating flavors and fragrances (reference 31) and it appears that safety requirements can be met, particularly if added flavors are natural tobacco components, and are little pyrolyzed or altered during smoking."
Q. Now is this an article in which the director of the National Cancer Institute's Smoking and Health Program is talking about cigarettes that he believed under his theory would present little or no risk?
A. That's correct, absolutely.
Q. And Dr. Gori was the chair of the National Cancer Institute Tobacco Working Group program.
A. He was indeed.
Q. Now on that same page, before we take that off, there was one followup question I wanted -- first page.
When Dr. Gori is speaking -- or writing about the protonated and unprotonated, do you see that?
A. Yes.
Q. Then he goes on, "The latter form," that is, the unprotonated, "increases with alkalinity and appears

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to be more readily absorbed." Do you see that?
A. Yes.

Q. Then he goes on to say "more important still." What does Dr. Gori says is more important still from the effect of the unprotonated nicotine?
A. "More important still, it has decidedly satisfying effects on the smoker's taste receptors," and then references 28.
Q. Is nicotine impact in the mouth what's referred to by cigarette designers as impact?
A. Yes.
Q. What does the word "organoleptic" mean?
A. Well it's a general sensory response in the oral cavity. One form.
Q. And does nicotine cause an organoleptic effect?
A. Certainly nicotine --
MR. CIRESI: Excuse me. Objection, Your Honor, there's no foundation for this witness.
THE COURT: You can answer that.
A. Nicotine in the oral cavity will create sensation a lot like carbon dioxide in -- or in carbonated beverages will create a -- a harsh sensation in the oral cavity. Nicotine certainly does that as well.
Q. Now let me go back for another suggestion along these same lines, back to the Banbury report at page 358?

A. I'm sorry, what tab is that again?
Q. I'm sorry, Dr. Townsend. That is tab 25. Do you have that?
A. Yes.
Q. Would you start at the paragraph at the top upper left-hand that says -- starts out "At the end...."
A. Page 25? I'm sorry.
Q. Page 358 in the summary of the Banbury report.
A. Okay. Okay. Page 358.
Q. Starts out "At the end...?"
A. Yes. "At the end of this review one cannot avoid a special consideration for nicotine which, besides being a major contributor to the taste and smell of smoke, is the most important pharmacologic principle in the complex relationship of the smoker and the cigarette (see Russell). A central question for nicotine regards its chronic toxicity, about which little is known in spite of a vast amount of research. Studies now in progress under the Smoking and Health Program of the National Cancer Institute aim at resolving this question. Should nicotine be found to have only minor chronic significance, as the case appears to be, then tar reduction and nicotine preservation would be desirable objectives for less

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hazardous cigarettes. This approach presumably would provide satiation to the smoker, reduce his propensity to either smoke more cigarettes or take deeper compensatory inhalations, and at the same time reduce other undesirable components."

Q. Now as a cigarette designer, what does it mean when the Banbury report in its summary, what was the significance of the statement that tar reduction and nicotine preservation would be desirable objectives for less hazardous cigarettes?

A. As a cigarette designer, that means to me to maintain some consumer acceptable levels of nicotine but reduce tar levels as low as you can go and maintain consumer acceptance.

Q. Now could you turn to tab 36, again another document already in evidence, that's GI all zeroes with a nine on the end. Do you have that?

A. Yes, sir.

Q. And could you turn to paragraph 20 and read that. Well before we do that, let -- let me just confirm, this is a report from the Independent Scientific Committee on Smoking and Health to the British government; correct?

A. That's correct.

Q. And this is their 1983 report?

A. This is the 1983 Froggatt Committee report to the British government.

Q. All right. Could you read paragraph 20.

A. "As nicotine is an important factor in perpetuating the smoking habit and as the evidence is not convincing that the lower limit of nicotine acceptability has been reached we wish to encourage a lower nicotine intake on the ground that this will reduce dependence on tobacco and thus help smokers to give up. Additionally, there is no clear evidence of marked compensation over long periods; so even accepting that some may occur, the lowering of tar and nicotine yields would still result in average -- in reduced average intakes of these substances. We accordingly recommend that, in general, nicotine levels should fall. We also believe that there should be available to the public some brands with tar yields below those of the present principal low Tar Brands (ie about 8 milligrams per cigarette), but with proportionately higher nicotine yields (up to about 1 milligram). There should be careful monitoring of public acceptance of such brands and of the extent of 'compensation' both in those who use them and in those who smoke more conventional low tar cigarettes."

Q. Now is this statement by the Independent Scientific Committee on Smoking and Health in Britain that tar should be reduced, there should be some cigarettes with proportionately higher nicotine

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yields, is that consistent with some of the observations we've seen so far from Dr. Gori in the Journal of the National Cancer Institute and Banbury report?
A. It's entirely consistent with those other reports.
Q. Now did the Surgeon General himself recommend the performance of research and the production of cigarettes that lead to maximum satisfaction with perhaps substantial yields of nicotine?
A. He did.
Q. Would you turn to the 1981 Surgeon General's report. I think that's in as PX3838. Turn to page -- we'll start out on page 184, please.
A. I'm sorry, can you tell me again which page?
Q. 184, doctor.
A. Yes.
Q. Now the recommendations here for research, do you see that, research cigarettes?
A. Yes.
Q. Then can you start at the bottom of the page

with "Variations in tar to nicotine ratio...?"
A. Okay.
Q. And before you do that, doctor, let me ask you this: When they talk about variations in tar-to-nicotine ratio, is that the same subject these other articles have been talking about about reducing tar but maintaining some level of nicotine?
A. It is the same issue, reducing tar, maintaining some acceptable level of nicotine. Essentially it means that you -- you break the tar-to-nicotine ratio. Remember earlier -- well in fact there it is, the Samet chart shows the tar-and-nicotine ratios declining more or less proportionately, and what this -- what this approach to cigarette design would mean is really breaking the ratio of tar to nicotine, maintaining nicotine at an acceptable level and reducing tar much, much further.
Q. All right. With that explanation, could you read over to -- finish that paragraph on the next page?
A. Yes. "Variations in tar to nicotine ratios should be of special concern (reference 57). It is important to determine the lowest ratios that still produce a satisfying cigarette. Obviously, identical 'tar' and nicotine ratios can occur in cigarettes

that have very different standard nicotine yields. Research could show if there is an optimum combination of standard yield and ratio that leads to a maximum satisfaction and minimum exposure to toxic products. Cigarettes that vary systematically in 'tar' to nicotine ratios are needed for this research."
Q. Now is this recommendation for research consistent with the theory put forward, for example,

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by Dr. Russell in 1973 in that article we talked about?
A. It is consistent with Dr. Russell's theory.
Q. Now could we turn, still on that same page, go down to "Toxicology of Nicotine," and could you read over into that next paragraph again from the Surgeon General's report.
A. "Toxicology of Nicotine.
"A probable outcome of behavioral research will be that nicotine is the primary pharmacological reinforcer for cigarette smoking."
Q. And I'm having trouble finding the next page here myself. Would you like to go over to page 186? How about --
MR. WEBER: Your Honor, could I borrow the witness's version of --

Oh, we found it. I'm sorry.
Q. I interrupted you, Dr. Townsend. Could -- could you read that again for me, starting on 185 and we'll go over to 186.
A. Yes. My copy is actually missing 186.
MR. CIRESI: Here.
A. "Toxicology of Nicotine.
"A probable outcome of behavioral research will be that nicotine is the primary pharmacological reinforcer for cigarette smoking. If this" -- next page, please.
(Document handed to the witness.)
A. "If this prediction is correct, a lower 'tar' and nicotine cigarette that will be used by smokers and that will maximize the exposure to other toxic components of smoke" -- I'm sorry, "that will minimize the exposure of other toxic components of smoke may require substantial yields of nicotine. Consideration of the toxicity of nicotine, then, may become crucial in determining whether the benefits of lower 'tar' and nicotine cigarette smoking outweigh the costs."
Q. Now does this statement by the Surgeon General address the issue of consumer acceptance of cigarettes?

A. Well it certainly does.
Q. Could you explain that.
A. Well it's -- in --
In this second line on the second page he's talking about lower tar-to-nicotine ratios, but must be used by smokers, and to me that's -- that's the requirement that cigarettes of this -- of this -- these designs must be acceptable to the smokers; otherwise, you haven't made any progress in cigarette modification.
Q. Now we've discussed documents on this general theory of breaking the tar/nicotine ratio from the Journal of the National Cancer Institute in '72 and Dr. Russell in 1973, from the 1981 Surgeon General's

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report, in the Banbury report, the 1983 Committee of -- the British Independent Scientific Committee. Was there also a scientist at R. J. Reynolds who was considering these same theories?
A. Yes, there were scientists at R. J. Reynolds who had considered these theories.
Q. Could you turn to tab 56. That's PX12408.
A. Okay.
Q. And that's a document by Dr. Claude Teague; is it not?
A. That's correct.

Q. And the date on that is April 1972?
A. April 14th, 1972.
Q. Now have you reviewed this document?
A. Yes, I have.
Q. Do you agree with all of Dr. Teague's observations in this memorandum as one who has been in cigarette design and studies for 20 years at R. J. Reynolds?
A. No, I don't agree with all of what Teague says here, I certainly don't.
Q. Now the jury is familiar with this document, they've seen it a number of times, but I'd like you to read a portion -- read for the jury a portion of Dr. Teague's document that hasn't been read in evidence by any of the other witnesses who addressed this document. I'd like you to start down on page six at that paragraph right there that begins "Our critics...."
A. Okay.
Q. Do you have another copy of that?
A. Dr. Teague says, "Our critics have lumped 'tar' and nicotine together in their allegations about health hazards, perhaps because 'tar' and nicotine are generated together in varying proportions when tobacco is smoked. An accompanying research planning

memorandum suggests an approach to reducing the amount of 'tar' in cigarette smoke per unit of nicotine. That is probably the most realistic approach in today's market for conventional cigarette products. However, another more futuristic approach is possible which goes more directly to the fundamentals of the alleged problem."
Q. Now when doctor --
When that refers to an approach to reducing the amount of tar in smoke per unit of nicotine, what's that referring to?
A. Well that's referring to exactly the same concept that we've been talking about through these last number of documents, the Russell -- the Russell theory, the Russell hypothesis.
Q. Is the same concept discussed in the Surgeon General's report in 1981?
A. It is the same in the Surgeon General's report.
Q. Now has Reynolds researched theories of this

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type that we've been discussing in its research and development department?
A. Of course we've researched this theory. We've researched a number of theories. This is the scientific approach; we take theories whether they're generated outside or inside, and we test them.

Q. Did you --
Could you turn to tab 57, if you would. It's AT000576.
A. Okay.
Q. And can you identify that as a document of Dr. Senkus's dated December 16, 1976?
A. It's a document -- a memo from Dr. Murray Senkus to Mr. J. F. Hind, December 16th, 1976.
Q. And was this document created and maintained in the regular course of Reynolds' business?
A. Yes. This is an RJR document.
MR. WEBER: Your Honor, I'd move this under 803(16) as an ancient document, or under 803(6) as a business record.
MR. CIRESI: No objection, Your Honor.
THE COURT: Court will receive AT000576.
BY MR. WEBER:
Q. Now, if I could turn you to the memorandum itself, Dr. Townsend, could you read that -- I know it's a little hard given the age, but could you read that first paragraph.
A. "Attached is a copy of an article entitled 'Low-Risk Cigarettes: A Prescription,' by Dr. Gio Gori, the Deputy Director of the Division of Cancer Cause and Prevention of the National Cancer

Institute. He is also the Director of the Smoking and Health Program of the Institute."
Q. All right. Let's move down past the technical part to where the fourth article -- fourth paragraph starts "The article...."
A. "The article suggests that the tar to nicotine ratio should be as low as possible to achieve maximum taste and smoke satisfaction."
Q. Now is the article he's referring to "Low-Risk Cigarettes" by Dr. Gori, the article in Science that appeared in December 1976 that you discussed earlier?
A. That's correct, that is the same article from 1976.
Q. So this memorandum is within the same month of the publication of the article by Dr. Gori.
A. Yes.
Q. All right. Would you go on to the next few paragraphs.
A. "This article is worthy of our attention for several reasons.
"First, it appears in a very eminent scientific journal, namely, 'Science,' which is the official publication of the american association for the Advancement of Science. 'Science' has very high

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standards for its articles. Its contents have been carefully evaluated from a scientific standpoint, and it will be widely read in the scientific community.

"Second, the article will add momentum to the swing toward low tar-good nicotine impact cigarettes." The latter words are underlined.

"Third, Dr. Gori appears to be gaining support in scientific and medical circles for the views expressed in the article.

"It all adds up to more publicity and hence a greater public awareness of the low tar cigarette with optimum nicotine."

Q. Now based upon Dr. Senkus's memorandum in that paragraph "Third...," did it appear to Reynolds at the time that the Gori's view were in fact representing a broader range of scientists?

A. I think that's correct, yes.

Q. Could you turn now to tab 58, which is AT000575, and can you identify that as a memorandum from Dr. Senkus to Mr. Hind entitled "UPDATE ON THE SMOKING AND HEALTH ISSUE AND SMOKING SATISFACTION," dated November 17, 1977?

A. That's absolutely correct.

Q. Okay. Was this record created and maintained in the regular course of Reynolds' business?

A. This is an R. J. Reynolds document.

MR. WEBER: Your Honor, I'd move the admission of this document under 803(16) and under 803(6).

MR. CIRESI: No objection, Your Honor.

THE COURT: Court will receive AT000575.

BY MR. WEBER:

Q. Now let me ask you some questions about this. Let's go to the table of contents, if we could. And what he does, Dr. Senkus, in 1977, from this memorandum, is give an update on the smoking-and-health issue, and then references a number of different institutions and governmental agencies; correct?

A. That's correct. There's a long list.

Q. And he lists a number of sources at the end as well. Now I'd like to start you off at page 7094, that's the Bates number down at the bottom of the page.

A. Yes.

Q. And that's where we begin to talk -- or Dr. Senkus's memorandum starts talking about the Smoking and Health Program of the National Cancer Institute.

A. Yes.

Q. Could you read that first paragraph there.

A. "The smoking and health program of the National

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Cancer Institute was instituted in 1968. In establishing the smoking and health program, the Institute recognized that a very substantial part of the population will continue to smoke and in view of this presumption, and in view of the government belief that smoking is hazardous to health, the program was assigned the goal of developing an allegedly safer cigarette."

Q. Now would you take a look at the list of characteristics that Dr. Gori had concluded might provide safer smoking. Is that roughly the same list that was given at the meeting of the Tobacco Working Group and recorded in Dr. Senkus's minutes of that meeting as we discussed earlier?

A. I believe it is the same -- the same list. Some of the words are a little different, but the same concepts.

Q. And if you pay attention to the numbers six and seven for me, Dr. Townsend, talks about reducing nicotine to an appropriate level, and tar reduced to as low a level as conceivably possible. If you put those two together, what concept is that referring to?

A. Well then you're back to the medium nicotine/ low tar Russell hypothesis to a safer cigarette.

Q. Now if you could turn to page four -- I'm sorry, 7096, and in a section relating to the American Cancer Society, does Dr. Senkus discuss some of the activities of the American Cancer Society in 1977?

A. Yes.

Q. And then down at the bottom does he discuss a talk made by a recent president of the American Cancer Society?

A. Yes.

Q. Would you read that paragraph that says "To date..." to the ladies and gentlemen of the jury.

A. "To date the Society has not issued a report on these proceedings; however, it would seem that its recommendations regarding restriction of smoking have changed recently in view of the recent election of Dr. R. Wayne Rundlos as the new President of the Society. In a talk in Durham to the City Chapter and speaking on behalf of the Society, he stated that we cannot abolish smoking and recommended that consumers change to low 'tar' cigarettes. In view of Dr. Rundlos' election to the Presidency, it can be expected that the American Cancer Society will take a more reasonable view of the smoking and health issue."

Q. Now is that position of the president of the

American Cancer Society there consistent with the statements and suggestions from others we reviewed earlier today as to what smokers should do if they're not going to quit smoking; that is, switch to low tar cigarettes?

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A. That is consistent with other things we've seen today.
Q. Now if you go over to page 7098 -- excuse me, 7097, and that references the Institute of Psychiatry at the University of London?
A. That's correct.
Q. And this discusses some of the theories of Dr. Russell; correct?
A. That's correct.
Q. Would you read the last paragraph on that page.
A. "Dr. Russell believes that the safest cigarette is likely to be the one with a very -- with a low 'tar' yield and a low CO yield and a high nicotine yield. With selective and ventilated filters, he believes it is likely that the manufacturers will soon be able to reduce 'tar' and CO substantially and still maintain sufficient nicotine."
Q. Okay. Could you turn to page -- the next page, page six or Bates number 7098. And that references some viewpoints from experts at the Department of

Psychiatry, UCLA, and at the VA Hospital in California?
A. Yes.
Q. And one of those is Dr. Jarvik?
A. Yes.
Q. Could you turn to the next page, 7099, and in that last paragraph before "Columbia University," could you read what the observation is by Dr. Jarvik.
A. Which paragraph?
Q. The one right above where it says "Columbia University."
A. Yes.
"Dr. Jarvik feels very strongly that every effort should be made to encourage people who choose to smoke to switch to low tar cigarettes with a higher yield of nicotine relative to 'tar' and carbon monoxide. He is confident that people who are now smoking higher 'tar' cigarettes will experience little difficulty in making the switch to the low 'tar' cigarettes with adequate nicotine. He did not specify what he considers adequate nicotine but he did say it would be appreciably above the 0.1 milligram level."
Q. And could you turn on to 7104 Bates number, where it references the Federal Trade Commission.

A. Okay.
Q. And could you read the second paragraph there. This is, again, in 1977.
A. Yes. "Relying on the recommendations of certain scientific and medical organizations which alleged that smokers should be encouraged to reduce 'tar' and nicotine intake, the U.S. government though -- through -- through the agency of the Federal Trade Commission arranged in 1967 for the periodic determination and publication of 'tar' and nicotine

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values of all cigarette brands. The first report on 59 brands was issued November 22nd, 1967. Since that time, reports have been issued approximately at 6-month intervals. The most recent report, the 19th, was issued on December 10, 1976, and it listed 169 brands, an increase of 110 brands from November 1967 to December 1976."
Q. Now doctor, according to this that we've just read, who had made the recommendations that smokers should be encouraged to switch to low tar cigarettes? If you go to the first paragraph, the beginning of the paragraph you just read.
A. Oh, at the beginning of the paragraph. Yeah. The U.S. government.
Q. All right. Now --

A. I'm sorry, the scientific and medical organizations.
Q. Made the recommendation --
A. Yes.
Q. -- according to the memorandum. All right.
A. That's what it says.
Q. Can you turn to the next page, which I think is 7105. Refers to the American Health Foundation.
A. Okay.
Q. And you mentioned the American Health Foundation several times yesterday. Just quickly, could you refresh the ladies and gentlemen as to what the American Health Foundation is, who -- who's involved in it?
A. The American Health Foundation is a contract laboratory and is headed by Professor Wynder that we've talked about a number of times. Dr. Dietrich Hoffmann is also on the staff there at very high level, has conducted research there for many, many, many years. Dr. Klaus Brunnemann, I think, was another scientist who has -- has been involved in tobacco and tobacco smoke chemistry for -- for a number of years. So there are a number of scientists there.
Q. Now I'd like you to look at that

second-to-the-last paragraph on the bottom of the page reporting on Dr. Wynder's viewpoint in 1977. Could you read that.
A. "After some twenty-five years of laboratory experiments and epidemiological studies, Dr. Wynder has abandoned the idea of using additives or extractions as a means for modifying cigarettes. In his most recent talk -- talks and publications he recommends the reduction of 'tar' intake in order to reduce the allegedly harmful effects of cigarette smoke. In essence he agrees with Dr. Gori of the National Cancer Institute whose views on allegedly safer smoking are set forth on pages 2 and 3 of this report."
Q. Now does Dr. Senkus go on on the next page,

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7106, to prepare a short summary and recommendations in this memorandum in which he did an overview of smoking-and-health issues?
A. Yes, he has.
Q. And could you start right at the top on that.
A. It is "Short Summary and Recommendations.
"A. Recommended 'tar', nicotine, and carbon monoxide values.
"Publications issuing from the National Cancer Institute, the Department of Psychiatry of the

University of London, the Department of Psychiatry at the University of California at Los Angeles, and the University of Columbia, allege that for safer smoking, consumers should use brands with lower 'tar', lower carbon monoxide, and medium nicotine. Thus it is anticipated that cigarettes with 5 milligrams of 'tar', .5 to .8 milligrams nicotine, and 3 milligrams carbon monoxide will gain wider consumer acceptance."
Q. Now were those cigarettes being referred to there based on these recommendations from the National Cancer Institute, Department of Psychiatry at London, the Department of Psychiatry at UCLA and Columbia, would those cigarettes be cigarettes which presented a different tar-to-nicotine ratio than conventional cigarettes?
A. They would represent a different tar-to-nicotine ratio.
Q. And would those types of cigarettes be cigarettes in which there was a -- there was a greater amount of nicotine proportionate to each unit of tar?
A. Yes. For example, five milligram tar with a .8 milligram nicotine would have a very different nicotine-to-tar ratio or tar-to-nicotine ratio than

other cigarettes on the market, so the proportions would be quite different.
Q. Okay. Could you continue then.
A. "These cigarettes will obtain a 'qualified' endorsement as 'safer' smoking" -- I'm sorry, let me back up. "These cigarettes will obtain a 'qualified' endorsement as 'safer' smoking from an increasing number of health authorities and their sales will continue to grow as people begin to feel less anxiety about smoking them."
Q. All right. And just continue down through the rest.
A. "R. J. Reynolds Tobacco Company has the technology, the manufacturing and the marketing capabilities to introduce and successfully market brands in this category.
"Development and introduction of these brands is recommended.
"B. Raw materials.
"Tobaccos with higher nicotine content will be

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needed than currently available to meet the requirements for the forthcoming low-'tar', medium-nicotine brands. It is probable that seed for these tobaccos may have already been developed. Availability of seed for farmers should be expected

to enable agronomic production of the higher nicotine tobaccos."

Q. Now did R. J. Reynolds undertake research responsive to these theories and suggestions?

A. R. J. Reynolds did conduct research that's responsive to those suggestions.

MR. WEBER: Your Honor, I'm about to move into a more substantive area on that research. I don't know what the court's plan is for today.

THE COURT: Oh well, why don't we recess then. We'll reconvene tomorrow morning at 9:30.

THE CLERK: Court stands in recess, to reconvene tomorrow morning at 9:30.

(Recess taken.)

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